AUTOSTRADA (A14) : BOLOGNA–BARI–TARANTO

TRATTO: BOLOGNA S.LAZZARO – NUOVO SVINCOLO DI PONTE RIZZOLI

NUOVA STAZIONE DI PONTE RIZZOLI
E
REALIZZAZIONE DELLA COMPLANARE NORD

PROGETTO DEFINITIVO

SVINCOLO BORGATELLA

OPERE D'ARTE MAGGIORI

NUOVO CAVALCAVIA CV001–B E SOTTOVIA ST003–B

CAVALCAVIA CV001–B
RELAZIONE TECNICA DI CALCOLO IMPALCATO

IL PROGETTISTA SPECIALISTICO	IL RESPONSABILE INTEGRAZIONE PRESTAZIONI SPECIALISTICHE	IL DIRETTORE TECNICO
Ing. Lucio Ferretti Torricelli Ord. Ingg. Brescia N.2188 RESPONSABILE STRUTTURE	Ing. Federica Ferrari Ord. Ingg. Milano N. 21082	Ing. Orlando Mazza Ord. Ingg. Pavia N. 1496 PROGETTAZIONE NUOVE OPERE AUTOSTRADALI

CODICE IDENTIFICATIVO

RIFERIMENTO PROGETTO			RIFERIMENTO DIRETTORIO					RIFERIMENTO ELABORATO				Ordinatore:
Codice Commessa	Lotto, Sub-Prog, Cod. Appalto	Fase	Capitolo	Paragrafo	WBS tipologia	WBS progressivo	PARTE D'OPERA	Tip.	Disciplina	Progressivo	Rev.	00
111439	0001	PD	00	00	00	00	000000	0	STR	0060	00	SCALA: --

PROJECT MANAGER:	SUPPORTO SPECIALISTICO:
Ing. Federica Ferrari Ord. Ingg. Milano N. 21082	
REDATTO: –	VERIFICATO: –

REVISIONE	
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0	GENNAIO 2017
1	–
2	–
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4	–

spea ENGINEERING gruppo Atlantia

VISTO DEL COMMITTENTE	VISTO DEL CONCEDENTE
autostrade per l'italia IL RESPONSABILE UNICO DEL PROCEDIMENTO Ing. Antonio Procopio	Ministero delle Infrastrutture e dei Trasporti DIPARTIMENTO PER LE INFRASTRUTTURE, GLI AFFARI GENERALI ED IL PERSONALE STRUTTURA DI VIGILANZA SULLE CONCESSIONARIE AUTOSTRADALI

INDICE

1. GENERALITA'

1.1. OGGETTO E SCOPO

La seguente relazione di calcolo è relativa all'analisi e al dimensionamento dell'impalcato del cavalcavia di svincolo tra la complanare nord di Bologna e l'autostrada A14 prevista nell'ambito dei lavori di completamento della complanare nord di Bologna.

La struttura esistente è costituita da un impalcato a via inferiore in acciaio in semplice appoggio su una campata unica con luce di calcolo di 62,00 m.

La larghezza trasversale dell'impalcato è pari a 15,50 m, ed è realizzato tramite la disposizione di 2 travi in acciaio di altezza variabile da 240 cm a 360 cm, esterne all'impalcato, solidarizzate con una soletta di spessore 25 cm. La sezione trasversale è quindi definita da una piattaforma bitumata di larghezza 10,50 m e due marciapiedi da 1,50 m.

Le spalle risultano definite da una ciabatta di fondazione di dimensioni 17,00 x 9,40 m e spessore 2,00 m. Il paraghiaia, di spessore 0,35 cm, risulta di altezza variabile da 1,57 a 1,74 m. L'altezza dell'elevazione delle spalle risulta di 6,85 m.

Le fondazioni sono caratterizzate da 18 pali di diametro 1200 mm e lunghi 28 m. Gli apparecchi d'appoggio sono del tipo a disco elastomerico.

Di seguito si riportano le principali geometrie dell'opera. Per ulteriori dettagli si rimanda agli elaborati grafici di progetto.

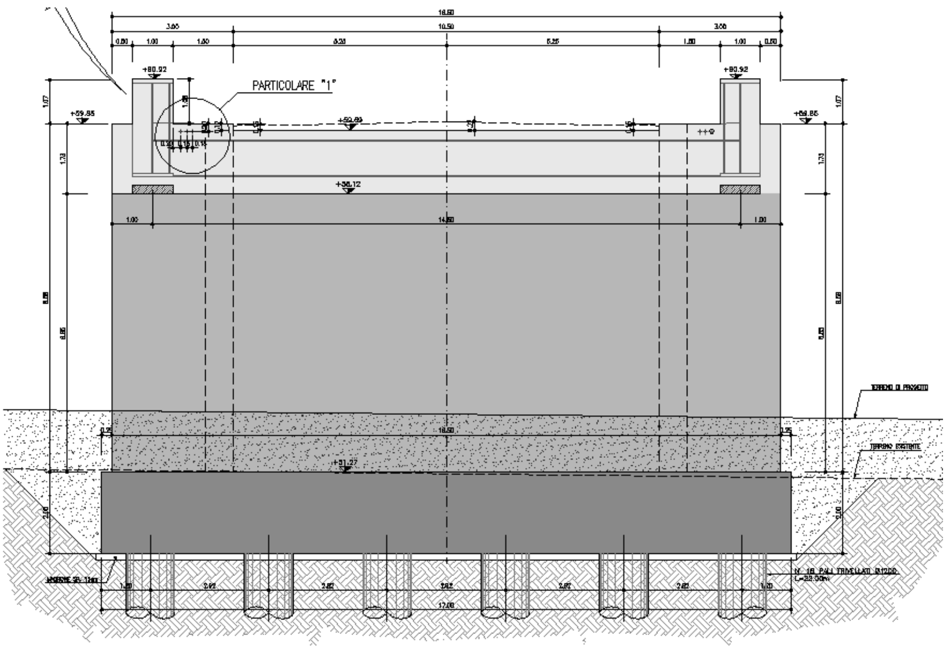


Figura 1.1: *Sezione frontale spalla*

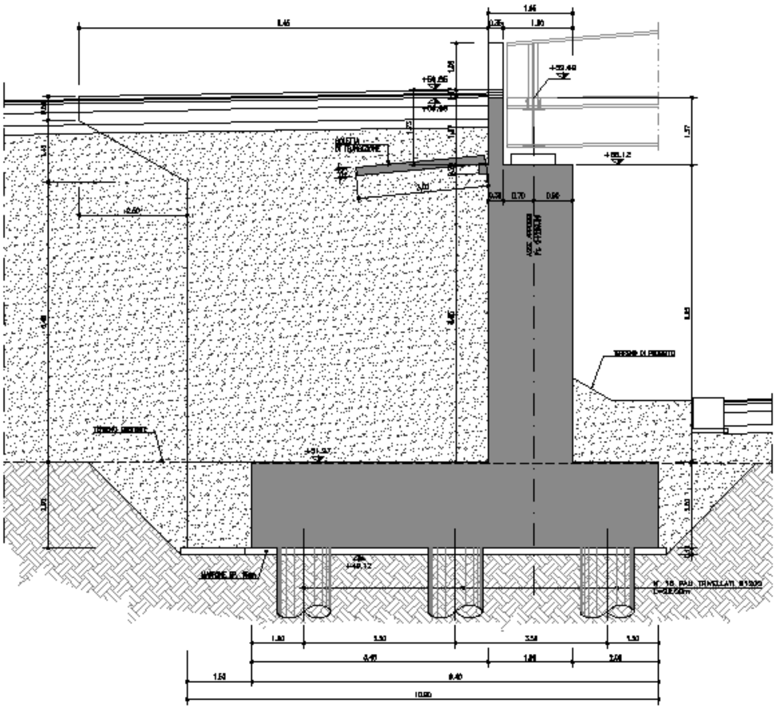


Figura 1.2*: Sezione trasversale spalla*

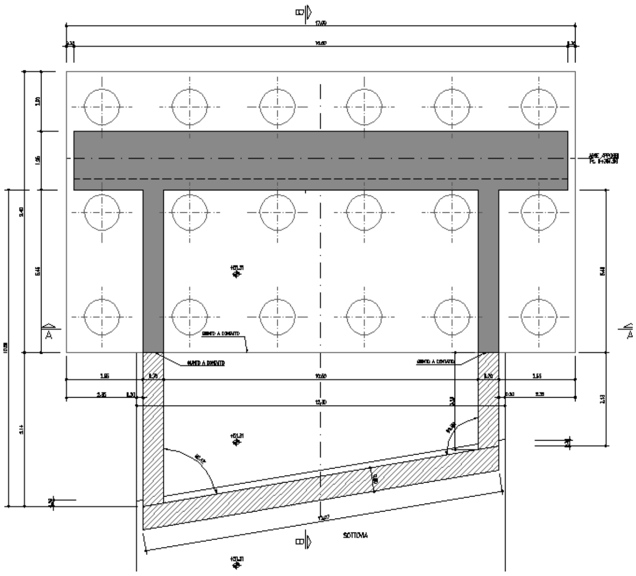


Figura 1.3*: Pianta fondazione spalla*

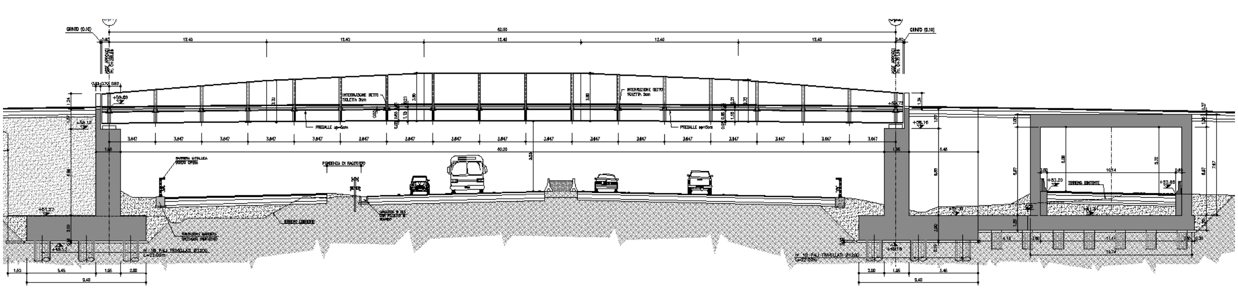


Figura 1.4*: Sezione longitudinale impalcato*

1.2. NORMATIVA DI RIFERIMENTO

Le analisi e le verifiche di seguito documentate sono state svolte nel rispetto della Normativa vigente di seguito richiamata:

- Legge 5 Novembre 1971 N° 1086 – "*Norme per la disciplina delle opere in calcestruzzo cementizio, normale e precompresso ed a struttura metallica*";
- Legge 2 Febbraio 1974 n.64: "*Provvedimenti per le costruzioni, con particolari prescrizioni per le zone sismiche*";
- D.M. 14/01/2008 "*Norme Tecniche per le Costruzioni*" - GU n°29 del 4/2/2008 (di seguito indicata con la sigla "NTC")
- Circolare 2 febbraio 2009, n. 617 del Ministero delle Infrastrutture e dei Trasporti approvata dal Consiglio Superiore dei Lavori Pubblici "*Istruzioni per l'applicazione delle "Nuove norme tecniche per le costruzion*i" - Gazzetta Ufficiale del 26.02.2009 n. 47, supplemento ordinario n. 27.
- CNR DT 207/2008 "*Istruzioni per la valutazione delle azioni e degli effetti del vento sulle costruzioni*".
- CNR 10012/85: "*Istruzioni per la valutazione delle azioni sulle costruzioni*".

Per quanto non definito dalle sopra citate norme, nella stesura dei calcoli è stata consultata anche la seguente normativa internazionale:

- UNI EN 1991-2:2003 Eurocodice 1- *Azioni sulle strutture – Parte 2: Carichi da traffico sui ponti*
- UNI ENV 1992-1-1:2005: Eurocodice 2 – *Progettazione delle strutture in calcestruzzo – Parte 1-1: Regole generali e regole per gli edifici*.

1.3. ELABORATI DI RIFERIMENTO

Di seguito si riportano gli elaborati grafici di riferimento dell'intervento in progetto a cui si rimanda per tutte le indicazioni di dettaglio.

154 STR 067 Cavalcavia CV 001 e sottovia ST003-B – Assieme
155 STR 067 Cavalcavia CV 001 e sottovia ST003-B – Spalla 1 - Piante
156 STR 067 Cavalcavia CV 001 e sottovia ST003-B – Spalla 1 – Sezioni
157 STR 067 Cavalcavia CV 001 e sottovia ST003-B – Spalla 2 - Piante
158 STR 067 Cavalcavia CV 001 e sottovia ST003-B – Spalla 2 – Sezioni
161 STR 067 Cavalcavia CV 001 e sottovia ST003-B – Carpenteria metallica - Assieme
162 STR 067 Cavalcavia CV 001 e sottovia ST003-B – Carpenteria metallica – Traversi "T1" e "T2"

163 STR 067 Cavalcavia CV 001 e sottovia ST003-B – Carpenteria metallica – Traversi “T3”
164 STR 067 Cavalcavia CV 001 e sottovia ST003-B – Particolari appoggi e giunti

1.4. INQUADRAMENTO SISMICO

Si richiama di seguito l’inquadramento sismico del sito di intervento.

Vita nominale:	50anni
Classe d’uso:	IV → Cu = 2.0
Vita di riferimento:	100 anni
Accelerazione massima su suolo tipo A:	a_g = 0.210g
Categoria topografica:	T1
Tipo di suolo:	C
Coeff. di amplificazione topografica S_T:	1.00
Coeff. di amplificazione stratigrafica S_S:	1.37 (suolo tipo C)
Accelerazione massima al sito:	a_{max} = 0.31g (suolo tipo C)

2. **MATERIALI**

Calcestruzzo

I materiali per le strutture in cemento armato sono in accordo con le Norme Tecniche per le Costruzioni (NTC2008 – D.M. 14/01/2008), UNI EN 206:2006 e UNI 11104:2004 “Classi di esposizione per calcestruzzo strutturale”.

Il calcestruzzo ha le seguenti caratteristiche generali:

Coefficiente di Poisson	$\nu = 0,2$
Coefficiente di espansione termica	$\alpha = 1,00 \times 10^{-5}$ 1/°C
Peso specifico (compresa l’armatura)	$\rho = 25$ kN/m^3

Di seguito sono elencate le caratteristiche specifiche del calcestruzzo per i diversi tipi di impiego.

Solette

Classe di resistenza	C35/45
Resistenza caratteristica cubica	$R_{ck} \geq$ 45 N/mm^2
Resistenza caratteristica cilindrica	$f_{ck} \geq$ 37,35 N/mm^2
Modulo elastico secante	E = 34.625 N/mm^2
Classe di esposizione	XF4
Classe di consistenza	S4
Diametro massimo dell’aggregato	20 mm
Massimo rapporto A/C	0,45
Contenuto minimo di cemento	360 kg/m^3
Copriferro nominale	40 mm

Lastre prefabbricate

Classe di resistenza	C35/45
Resistenza caratteristica cubica	$R_{ck} \geq$ 45 N/mm^2
Resistenza caratteristica cilindrica	$f_{ck} \geq$ 37,35 N/mm^2
Modulo elastico secante	E = 34.625 N/mm^2
Classe di esposizione	XF4
Classe di consistenza	S4
Diametro massimo dell’aggregato	20 mm
Massimo rapporto A/C	0,45
Contenuto minimo di cemento	360 kg/m^3
Copriferro nominale	35 mm

Velette prefabbricate

Classe di resistenza	C35/45
Resistenza caratteristica cubica	$R_{ck} \geq$ 45 N/mm^2
Resistenza caratteristica cilindrica	$f_{ck} \geq$ 37,35 N/mm^2
Modulo elastico secante	E = 34.625 N/mm^2
Classe di esposizione	XF4
Classe di consistenza	S4
Diametro massimo dell'aggregato	20 mm
Massimo rapporto A/C	0,45
Contenuto minimo di cemento	360 kg/m^3
Copriferro nominale	35 mm

Acciaio in barre

L'acciaio ha le seguenti caratteristiche generali:

Modulo elastico	E = 210.000 N/mm^2
Coefficiente di Poisson	ν = 0,3
Coefficiente di espansione termica	α = 1,20 x 10^{-5} 1/°C
Peso specifico	ρ = 78,50 kN/m^3

Di seguito sono elencate le caratteristiche dell'acciaio per armatura lenta sono:

Barre

Tipo di acciaio	B450C
Tensione caratteristica di snervamento	$f_{yk} \geq$ 450 N/mm^2
Tensione caratteristica di rottura	$f_{tk} \geq$ 540 N/mm^2
Rapporto tensioni caratteristiche	$1,15 \leq (f_t/f_y)_k < 1,35$
Rapporto tensioni di snervamento	$(f_y/f_{y,nom})_k < 1,25$
Allungamento a carico massimo	$(A_{gt})_k \geq 7,5\%$

Strutture in carpenteria metallica

I materiali per le strutture in carpenteria metallica sono in accordo con le Norme Tecniche per le Costruzioni (NTC2008 – D.M. 14/01/2008). Si riportano per ogni tipologia le norme di riferimento europee.

L'acciaio ha le seguenti caratteristiche generali:

Modulo elastico	E = 210.000 N/mm^2

Coefficiente di Poisson	$\nu = 0,3$
Coefficiente di espansione termica	$\alpha = 1,20 \times 10^{-5}$ 1/°C
Peso specifico	$\rho = 78,50$ kN/m^3

Acciaio per carpenteria

Elementi in acciaio saldato (t ≤ 40 mm)

Tipo di acciaio	S355J2G3
Tensione caratteristica di snervamento	$f_{yk} \geq 355$ N/mm^2
Tensione caratteristica di rottura	$f_{tk} \geq 510$ N/mm^2
Resilienza minima	$K_v = 27$ Joule
Temperatura prova resilienza	T = - 20°
Trattamento termico	Normalizzazione

Elementi in acciaio saldato (t > 40 mm)

Tipo di acciaio	S355K2G3
Tensione caratteristica di snervamento	$f_{yk} \geq 335$ N/mm^2
Tensione caratteristica di rottura	$f_{tk} \geq 470$ N/mm^2
Resilienza minima	$K_v = 40$ Joule
Temperatura prova resilienza	T = - 20°
Trattamento termico	Normalizzazione

Elementi non saldati, angolari e piastre

Tipo di acciaio	S355J0
Tensione caratteristica di snervamento	$f_{yk} \geq 355$ N/mm^2
Tensione caratteristica di rottura	$f_{tk} \geq 510$ N/mm^2
Resilienza minima	$K_v = 27$ Joule
Temperatura prova resilienza	T = 0°
Trattamento termico	Normalizzazione

Bulloni ad alta resistenza

Viti

Classe	10.9 (UNI EN 14399-4:2005)
Tensione caratteristica di snervamento	$f_{yb} \geq 900$ N/mm^2
Tensione caratteristica di rottura	$f_{uk} \geq 1.000$ N/mm^2

Dadi

Classe	10 (UNI EN 14399-4:2005)
	(UNI EN 20898-2:1994)
Durezza	HV = 272÷353

Rosette

Tipo di acciao	C50 (UNI EN 14399-6:2005)
	(UNI EN 10083-2:2006)
Resistenza a snervamento	R_e = 460 N/mm^2
Resistenza a trazione	R_m = 700÷850 N/mm^2
Durezza	HRC = 32÷40
Trattamento termico	Tempra e rinvenimento

Acciaio per piolature

Pioli tipo "Nelson" (UNI EN ISO 13918:2009)

Tipo di acciaio	S235J2G3+C450 (UNI EN 10025-2:2005)
	(UNI EN 10027-1:2006)
Tensione caratteristica di snervamento	$f_{yk} \geq 350$ N/mm^2
Tensione caratteristica di rottura	$f_{uk} \geq 450$ N/mm^2
Resilienza minima	K_v = 27 Joule
Temperatura prova resilienza	T = - 20°
Allungamento a rottura	$(A_5)_k \geq 15\%$
Trattamento	Incrudimento

3. METODI DI CALCOLO E DI VERIFICA

La schematizzazione di calcolo delle strutture progettate, il calcolo dei parametri di sollecitazione e la valutazione delle tensioni e delle deformazioni, allo scopo di ottenere la garanzia di una sicurezza permanente e uniforme dell'opera, sono stati effettuati secondo i metodi della scienza delle costruzioni e della teoria dell'elasticità.
Si sono analizzate le combinazioni più sfavorevoli delle condizioni elementari di carico al fine di individuare i valori massimi e minimi delle sollecitazioni cercate.
Il calcolo è stato eseguito in conformità alla vigente normativa tecnica e più precisamente alle già citate "Norme tecniche per le costruzioni" – D.M. 14/01/2008 (G.U. n.29 del 04/02/2008), ricorrendo al metodo degli Stati Limite.

3.1. PERCENTUALE MINIMA DI ARMATURA

Per la percentuale minima di armatura si considerano le prescrizioni delle NTC 2008 tenendo conto del tipo di sollecitazione agente sull'elemento.

3.2. COPRIFERRO

La determinazione del copriferro minimo si evince dalla tabella C4.1.IV della Circolare applicativa 617 delle NTC 2008.

3.3. VERIFICA DI FESSURAZIONE

In accordo con le NTC 2008 si considerano le aperture di fessure riportate in tabella 3.1 per gruppo di elemento strutturale.

Gruppi di elementi	Condizioni ambientali	Combinazione delle azioni	Armatura Poco sensibile	
			Stato limite	w_d
Fondazioni	Ordinarie	frequente	ap. fessure	≤ 0,4 mm
		quasi permanente	ap. fessure	≤ 0,3 mm
Elevazioni	Aggressive	frequente	ap. fessure	≤ 0,3 mm
		quasi permanente	ap. fessure	≤ 0,2 mm
Elevazioni	Aggressive	frequente	ap. fessure	≤ 0,3 mm
		quasi permanente	ap. fessure	≤ 0,2 mm

Tabella 3-1: Stato limite di fessurazione (NTC 2008 – tabella 4.1.IV)

4. METODO DI CALCOLO

4.1. VITA NOMINALE, CLASSI D'USO E PERIODO DI RIFERIMENTO

La vita nominale di un'opera strutturale è intesa come il numero di anni nel quale la struttura, purché soggetta alla manutenzione ordinaria, deve potere essere usata per lo scopo al quale è destinata.

Tabella 2.4.I – *Vita nominale V_N per diversi tipi di opere*

	TIPI DI COSTRUZIONE	Vita Nominale V_N (in anni)
1	Opere provvisorie – Opere provvisionali - Strutture in fase costruttiva[1]	≤ 10
2	Opere ordinarie, ponti, opere infrastrutturali e dighe di dimensioni contenute o di importanza normale	≥ 50
3	Grandi opere, ponti, opere infrastrutturali e dighe di grandi dimensioni o di importanza strategica	≥ 100

In presenza di azioni sismiche, con riferimento alle conseguenze di una interruzione di operatività o di un eventuale collasso, le costruzioni sono suddivise in quattro classi d'uso. La costruzione in oggetto rappresenta una rete viaria di importanza critica, pertanto le opere ad essa connesse sono da classificare in classe d'uso IV:

Opera tipo 2 (vita nominale V_N = 50 anni)

Classe d'uso IV (coefficiente C_u = 2.0)

$$V_R = V_N \cdot C_u = 50 \cdot 2.0 = 100\ anni$$

Le azioni assunte per il calcolo delle strutture in oggetto verranno valutate in relazione al periodo di riferimento V_R, assunto pari a 100 anni.

4.2. METODO SEMI-PROBABILISTICO AGLI STATI LIMITE

Ai fini delle verifiche degli stati limite si definiscono le seguenti combinazioni delle azioni.

4.2.1. Combinazione statica SLU

La combinazione per le verifiche statiche allo stato limite ultimo è:

$$F_d = \sum_{i=1}^{ng} \gamma_{gi} \cdot G_{ki} + \gamma_{q1} \cdot Q_{1k} + \sum_{i=2}^{nq} \gamma_{qi} \cdot \psi_{0i} \cdot Q_{ik}$$

dove:

G_{ki}	è il valore caratteristico delle azioni permanenti
Q_{1k}	è il valore caratteristico di una delle azioni variabili
Q_{ik}	è il valore caratteristico delle altre azioni variabili
γ_g	coefficiente parziale per la i-esima azione permanente
γ_q	coefficiente parziale per la i-esima azione variabile
ψ_{0i}	coefficiente di combinazione

Si riportano di seguito, in tabella 3.2, i valori dei coefficienti di combinazione per le azioni agenti sull'opera in esame.

AZIONI	GRUPPO DI AZIONI	ψ_{0i}	ψ_{1i}	ψ_{2i}
Azioni da traffico	Schema 1 (Carichi tandem)	0,75	0,75	0,00
	Schemi 1 e 5 (carichi distribuiti)	0,40	0,40	0,00
Vento q_5	Ponte scarico	0,60	0,20	0,00
	Ponte carico	0,60	-	-
Temperatura	T_k	0,60	0,60	0,50

Tabella 3.2: Valore dei coefficienti di combinazione (NTC 2008 – tabella 5.1.VI)

Si impiega un'unica combinazione dei gruppi di coefficienti parziali, definiti per le Azioni (A), per la resistenza dei materiali (M) e, eventualmente, per la resistenza globale (R). In tale approccio, per le azioni si impiegano i coefficienti γ_F riportati nella colonna A1 di tabella 3.3.

		Coefficiente γ_F	EQU(1)	A1 STR	A2 GEO
Carichi permanenti	favorevoli sfavorevoli	γ_{g1}	0,90 1,10	1,0 1,35	1,00 1,00
Carichi permanenti non strutturali(2)	favorevoli sfavorevoli	γ_{g2}	0,00 1,50	0,00 1,50	0,00 1,30
Carichi variabili da traffico	favorevoli sfavorevoli	γ_q	0,00 1,50	0,00 1,50	0,00 1,30
Carichi variabili	favorevoli sfavorevoli	γ_{qi}	0,00 1,50	0,00 1,50	0,00 1,30
Distorsioni e presollecitazioni di progetto	favorevoli sfavorevoli	$\gamma_{\varepsilon 1}$	0,90 1,00(3)	1,00 1,00(4)	1,00 1,00
Ritiro e viscosità, Variazioni termiche, Cedimenti vincolari	favorevoli sfavorevoli	$\gamma_{\varepsilon 2}$, $\gamma_{\varepsilon 3}$, $\gamma_{\varepsilon 4}$	0,00 1,20	0,00 1,20	0,00 1,00

(1) Equilibrio che non coinvolga i parametri di deformabilità e resistenza del terreno; altrimenti si applicano i valori di GEO.
(2) Nel caso in cui i carichi permanenti non strutturali (ad es. carichi permanenti non portati) siano compiutamente definiti si potranno adottare per essi gli stessi coefficienti validi per le azioni permanenti.
(3) 1,30 per instabilità in strutture con precompressione esterna.
(4) 1,20 per effetti locali.

Tabella 3.3: Valore dei coefficienti parziali di sicurezza (NTC 2008 – tabella 5.1.V)

4.2.2. Combinazione statica SLE

La combinazione per le verifiche statiche allo stato limite di esercizio sono:

Combinazione rara $$F_d = \sum_{i=1}^{ng} G_{ki} + Q_{1k} + \sum_{i=2}^{nq} \psi_{0i} \cdot Q_{ik}$$

Combinazione frequente $$F_d = \sum_{i=1}^{ng} G_{ki} + \psi_{1i} \cdot Q_{1k} + \sum_{i=2}^{nq} \psi_{2i} \cdot Q_{ik}$$

Combinazione quasi permanente $$F_d = \sum_{i=1}^{ng} G_{ki} + \sum_{i=2}^{nq} \psi_{2i} \cdot Q_{ik}$$

dove:

G_{ki} è il valore caratteristico delle azioni permanenti
Q_{1k} è il valore caratteristico di una delle azioni variabili
Q_{ik} è il valore caratteristico delle altre azioni variabili
ψ_{0i} coefficiente di combinazione per azioni rare
ψ_{1i} coefficiente di combinazione per azioni frequenti
ψ_{2i} coefficiente di combinazione per azioni quasi permanenti

Si riportano di seguito, in tabella 3.4, i valori dei coefficienti di combinazione per le azioni agenti sull'opera in esame.

AZIONI	GRUPPO DI AZIONI	ψ_{0i}	ψ_{1i}	ψ_{2i}
Azioni da traffico	Schema 1 (Carichi tandem)	0,75	0,75	0,00
	Schemi 1 e 5 (carichi distribuiti)	0,40	0,40	0,00
Vento q_5	Ponte scarico	0,60	0,20	0,00
	Ponte carico	0,60	-	-
Temperatura	T_k	0,60	0,60	0,50

Tabella 3.4: Valore dei coefficienti di combinazione (NTC 2008 – tabella 5.1.VI)

In tabella 3.5 sono riassunte le combinazioni di carico utilizzate nell'analisi del ponte, in particolare sono riportati i coefficienti moltiplicativi finali ottenuti dal prodotto tra i coefficienti parziali di sicurezza e quelli di combinazione.

Tabella 3.5: Combinazioni di carico utilizzate

	NOTA	COMBINAZIONE	STATO LIMITE	Peso proprio	Permanenti	Spinta terre, acqua	Distorsioni	Ritiro	Temperatura	Cedimenti	Sovr. Tandem	Sovr. distribuito	Folla marciapiedi	Frenata	Centrifuga	Vento	Neve	Sisma	Resistenze vincoli	Urti svio	Altre azioni
											schema1										
				g_1	g_2	g_3	ε_1	ε_2	ε_3	ε_4	Q_{ik}	q_{ik}	q_{if}	q_3	q_4	q_5	q_5	q_6	q_7	q_8	q_9
PONTE SCARICO	PONTE SCARICO (vento + Δt) SLU	U01	A1 - STR	1,35	1,35	1,35	1,00	1,20	0,72	1,20	0,00	0,00	0,00	0,00	0,00	1,50	0,00	0,00	1,50	0,00	0,00
	PONTE SCARICO (Δt + vento) SLU	U02	A1 - STR	1,35	1,35	1,35	1,00	1,20	1,20	1,20	0,00	0,00	0,00	0,00	0,00	0,90	0,00	0,00	1,50	0,00	0,00
	PONTE SCARICO (vento + Δt) SLE rara	F01	A1 - STR	1,00	1,00	1,00	1,00	1,00	0,60	1,00	0,00	0,00	0,00	0,00	0,00	1,00	0,00	0,00	1,00	0,00	0,00
	PONTE SCARICO (Δt + vento) SLE rara	F02	A1 - STR	1,00	1,00	1,00	1,00	1,00	1,00	1,00	0,00	0,00	0,00	0,00	0,00	0,60	0,00	0,00	1,00	0,00	0,00
	PONTE SCARICO (vento + Δt) SLE frequente	F03	A1 - STR	1,00	1,00	1,00	1,00	1,00	0,50	1,00	0,00	0,00	0,00	0,00	0,00	0,20	0,00	0,00	1,00	0,00	0,00
	PONTE SCARICO (Δt) SLE frequente	F04	A1 - STR	1,00	1,00	1,00	1,00	1,00	0,60	1,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	1,00	0,00	0,00
	PONTE SCARICO (Δt) SLE quasi permanente	F05	A1 - STR	1,00	1,00	1,00	1,00	1,00	0,50	1,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	1,00	0,00	0,00
	PONTE SCARICO (Δt) SISMA	S01	A1 - STR	1,00	1,00	1,00	1,00	1,00	0,50	1,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	1,00	1,00	0,00	0,00
PONTE CARICO	PONTE CARICO (gruppo 1 + vento + Δt) SLU	U03	A1 - STR	1,35	1,35	1,35	1,00	1,20	0,72	1,20	1,35	1,35	0,68	0,00	0,00	0,90	0,00	0,00	1,50	0,00	0,00
	PONTE CARICO (vento + gruppo 1 + Δt) SLU	U04	A1 - STR	1,35	1,35	1,35	1,00	1,20	0,72	1,20	1,01	0,54	0,68	0,00	0,00	1,50	0,00	0,00	1,50	0,00	0,00
	PONTE CARICO (gruppo 2a + vento + Δt) SLU	U05	A1 - STR	1,35	1,35	1,35	1,00	1,20	0,72	1,20	1,01	0,54	0,00	1,35	0,00	0,90	0,00	0,00	1,50	0,00	0,00
	PONTE CARICO (gruppo 1 + vento + Δt) SLE rara	F06	A1 - STR	1,00	1,00	1,00	1,00	1,00	0,60	1,00	1,00	1,00	0,50	0,00	0,00	0,60	0,00	0,00	1,00	0,00	0,00
	PONTE CARICO (gruppo 1 + vento + Δt) SLE frequente	F07	A1 - STR	1,00	1,00	1,00	1,00	1,00	0,50	1,00	0,75	0,40	0,50	0,00	0,00	0,20	0,00	0,00	1,00	0,00	0,00
	PONTE CARICO (gruppo 1 + Δt) SISMA	S02	A1 - STR	1,00	1,00	1,00	1,00	1,00	0,50	1,00	0,20	0,20	0,00	0,00	0,00	0,00	0,00	1,00	1,00	0,00	0,00

4.3. CODICI DI CALCOLO UTILIZZATI

Le analisi sono state svolte ricorrendo ai seguenti codici di calcolo:

- MIDAS CIVIL 2012 ver. 1.1, MIDAS Information Technology Co. Ltd, SKn Technopark Tech-center, 190-1 Sangdaewon1-dong, Joongwon-gu, Seongnam, Gyeonggi-do, 462-721, Korea
- RC-SEC ver. 2012.8.0.386, GeoStru Software, via Lungomare – 89032 BIANCO (RC)
- Fogli di calcolo appositamente predisposti per specifiche verifiche con Office Excel 2007, Microsoft.

5. ANALISI DEI CARICHI

Si riportano di seguito le analisi dei carichi agenti sul ponte in esame.

5.1. CARATTERISTICHE GEOMETRICHE IMPALCATO

L'impalcato ha le seguenti caratteristiche geometriche:

- Lunghezza totale impalcato	63,20 m
- Luce di calcolo	62,00 m
- Larghezza totale impalcato	15,50 m
- Larghezza carreggiata	10,50 m
- Larghezza marciapiede destro	1,50 m
- Larghezza marciapiede sinistro	1,50 m

5.2. PESO PROPRIO IMPALCATO E CARICHI PERMANENTI

Si riportano i carichi per le fasi di realizzazione del ponte.

Peso proprio:

- peso carpenteria metallica	50,38 kN/m
- soletta	90,63 kN/m
- marciapiede destro	7,50 kN/m
- marciapiede sinistro	7,50 kN/m

Sovraccarichi permanenti:

- pavimentazione bituminosa	3,00 kN/m^2
- sicurvia destro	0,70 kN/m
- sicurvia sinistro	0,70 kN/m

5.3. AZIONI VARIABILI DA TRAFFICO

Di seguito si riportano le sollecitazioni considerando le condizioni le azioni da traffico per ponte di 1ª categoria.

5.3.1. Definizione delle corsie convenzionali

L'impalcato ha le seguenti caratteristiche geometriche:

- Numero delle corsie 3
- Larghezza corsia 3,00 m
- Larghezza zona rimanente 1,50 m

Quindi i treni di carico sono divisi in:

- 1ª colonna di carico

  Q_{ik} = mezzo convenzionale da 300 kN a due assi (4 carichi concentrati da 150 kN)

  q_{ik} = carico ripartito da 9,00 kN/m^2 disposto lungo l'asse di una corsia d'ingombro da 3,00m

- 2ª colonna di carico

  Q_{ik} = mezzo convenzionale da 200 kN a due assi (4 carichi concentrati da 100 kN)

  q_{ik} = carico ripartito da 2,50 kN/m^2 disposto lungo l'asse di una corsia d'ingombro da 3,00m

- 3ª colonna di carico

  Q_{ik} = mezzo convenzionale da 100 kN a due assi (4 carichi concentrati da 50 kN)

  q_{ik} = carico ripartito da 2,50 kN/m^2 disposto lungo l'asse di una corsia d'ingombro da 3,00m

parte rimanente

  q_{ik} = carico ripartito da 2,50 kN/m^2

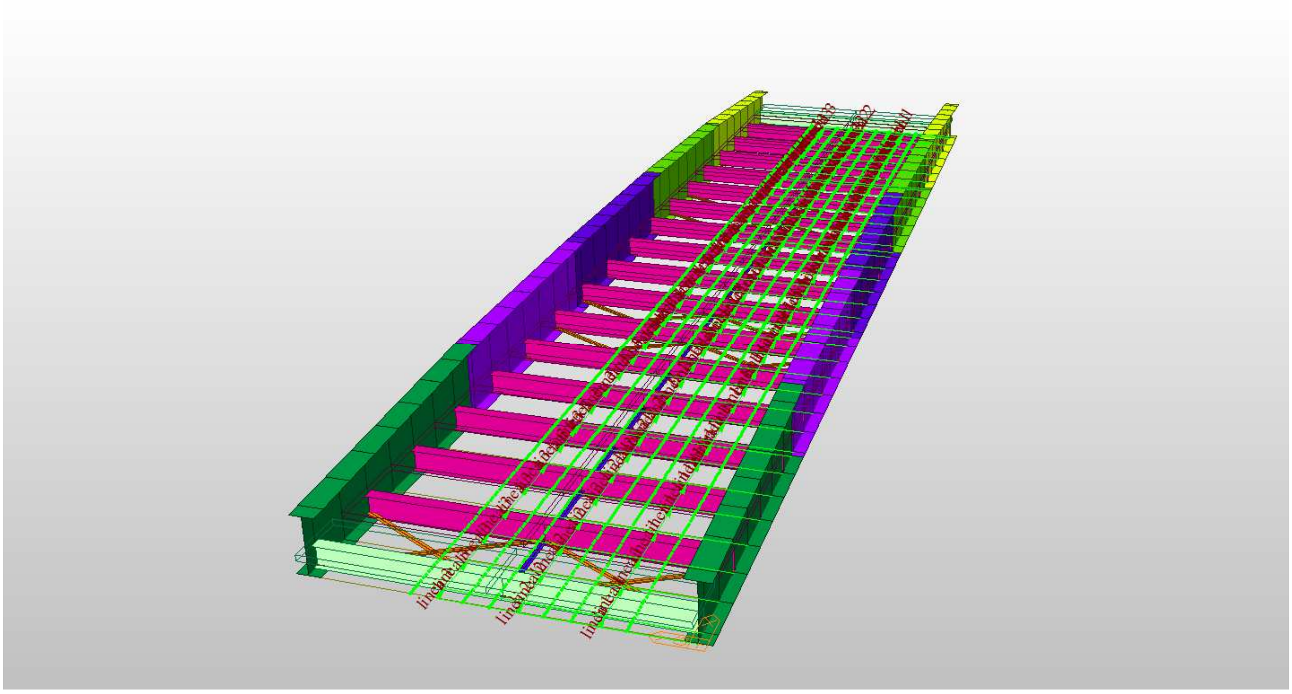


Figura 5.1*: Disposizione carichi mobili*

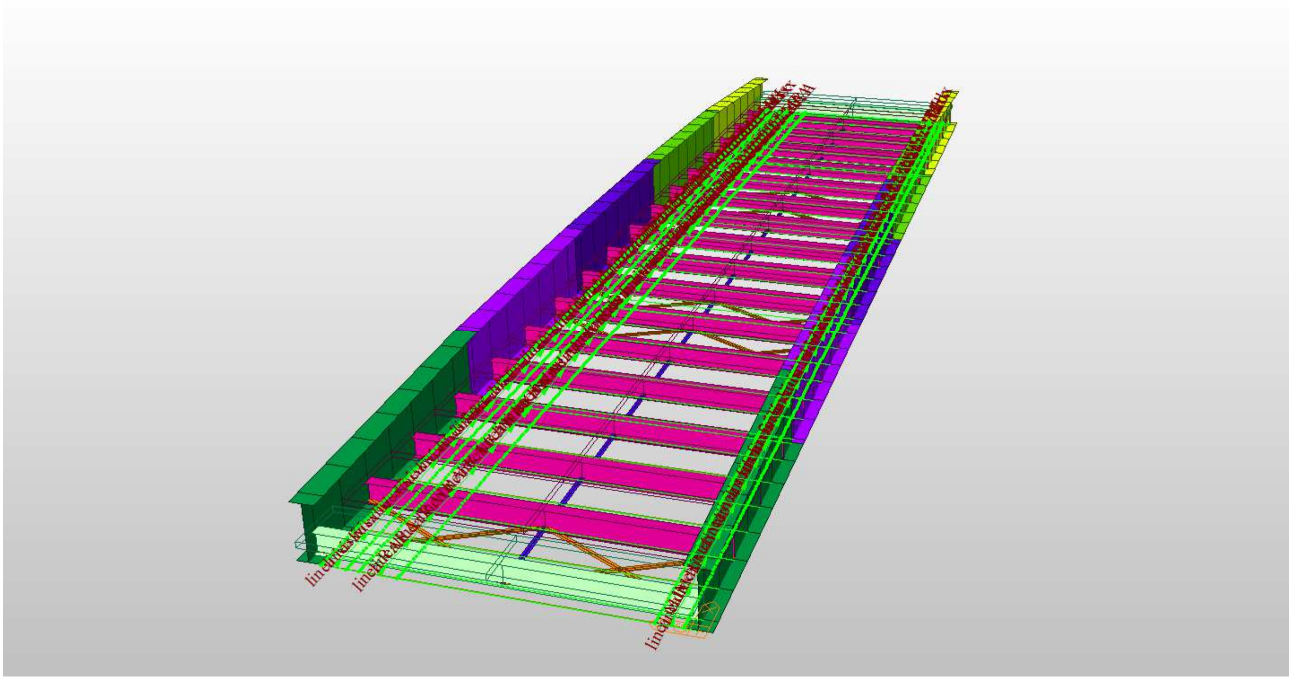


Figura 5.2*: Disposizione carico fascia rimanente e folla*

5.4. AZIONE LONGITUDINALE DI FRENAMENTO O ACCELERAZIONE (Q_3)

Per i ponti di 1ª categoria la forza di frenamento o di accelerazione q_3 è funzione del carico totale agente sulla corsia convenzionale n°1 è pari a:

$$q_3 = 0{,}6 \cdot (2 \cdot Q_{1k}) + 0{,}10 \cdot q_{1k} \cdot w_1 \cdot L$$

Il limite inferiore regolamentare per l'intensità delle forze di frenata è 180,0 kN, mentre quella superiore è di 900,0 kN.
Nel caso in esame si hanno i seguenti parametri:

- Q_{1k} = 300 kN
- q_{1k} = 9,00 kN/m^2
- w_1 = 3,00 m
- L = 63,20 m

Quindi il valore dell'azione è pari a:

$$q_3 = 0{,}6 \times (2 \times 300) + 0{,}10 \times 9{,}00 \times 3{,}00 \times 63{,}20 = 530{,}64 \text{ kN}$$

Lo scarico alla spalla fissa vale:

$$H_f = 530{,}64 \text{ kN}$$

5.5. AZIONE CENTRIFUGA (Q_4)

Il ponte è in rettifilo per sono assenti gli effetti di forza centrifuga.

5.6. AZIONE DEL VENTO (Q_5)

5.6.1. Definizione

Per il calcolo delle azioni del vento, le Norme Tecniche per le Costruzioni (D.M. 2008) prendono in esame situazioni progettuali in cui possono nascere particolari fenomeni di interazione vento-struttura. Tra questi vengono segnalati gli effetti torsionali sugli impalcati da ponte, per i quali si rimanda ad analisi specifiche e metodologie di comprovata validità. Si è quindi deciso di considerare l'azione del vento così come viene valutata con le nuove "Istruzioni per la valutazione delle azioni e degli effetti del vento sulle costruzioni" (CNR-DT 207/2008).

Il calcolo prevede l'individuazione di una pressione cinetica di picco del vento q_p funzione della Zona di riferimento, categoria di esposizione, classe di rugosità e tempo di ritorno dell'evento.
Questa pressione permette, quindi, la determinazione delle azioni aerodinamiche di picco esercitate dal vento, che possono essere espresse mediante una coppia di forze ortogonali f_X e f_Y e un momento torcente m_Z, per unità di lunghezza, applicati lungo l'asse Z di riferimento dell'impalcato. Essi sono forniti dalle relazioni:

$$f_X(z) = q_p(z) \cdot l \cdot c_{fX}$$

$$f_Y(z) = q_p(z) \cdot l \cdot c_{fY}$$

$$m_Z(z) = q_p(z) \cdot l^2 \cdot c_{mZ}$$

dove:

c_{fX}, c_{fY}, c_{mZ} coefficienti aerodinamici di forza e momento

l è la dimensione di riferimento associata ai coefficienti

I coefficienti aerodinamici per un impalcato isolato sono riportati in Tabella 5.3 in funzione del rapporto geometrico d/h_{tot} (vedi Figura 5.1)

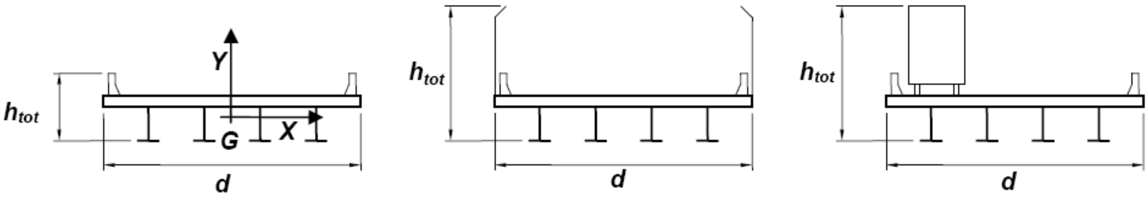


Figura 5.3 : Schema azioni vento ponte

Coefficiente aerodinamico	Indicazioni	Dimensione di riferimento
$c_{fX} = \begin{cases} 2{,}0 & 0{,}1 \le d/h_{tot} < 0{,}2 \\ 1{,}65 \cdot \log_{10}(d/h_{tot}) + 3{,}15 & 0{,}2 \le d/h_{tot} < 0{,}7 \\ -1{,}64 \cdot \log_{10}(d/h_{tot}) + 2{,}15 & 0{,}7 \le d/h_{tot} < 2 \\ \dfrac{1{,}85}{d/h_{tot}} - 0{,}10 & 2 \le d/h_{tot} \le 5 \\ \dfrac{1{,}35}{d/h_{tot}} & d/h_{tot} > 5 \end{cases}$	Struttura snella (CNR-DT207 - § G.10.3) (CNR-DT207 - § G.11.1)	$l = h_{tot}$ $l = d$
$c_{fY} = \begin{cases} \pm\left(0{,}7 + 0{,}1 \cdot \dfrac{d}{h_{tot}}\right) & 0 \le d/h_{tot} \le 5 \\ \pm 1{,}2 & d/h_{tot} > 5 \end{cases}$	(CNR-DT207 - § G.11.1)	$l = d$
$c_{mZ} = \pm 0{,}2$	(CNR-DT207 - § G.11.1)	$l = d$

Tabella 5.1: Coefficienti aerodinamici CNR-DT 207

5.6.2. Analisi

I parametri del sito dove sorge l'opera sono:

Zona	Descrizione	$v_{b,0}$ (m/s^2)	a_0 (m)	k_a
2	Emilia Romagna	25	750	0,015

Classe di rugosità	Esposizione sito	k_r	z_0 (m)	z_{min} (m)
B	IV	0,22	0,30	8

Tabella 5.2: Valori di riferimento da DM 2008

Altezza sito $a_s = 54{,}00$ m s.l.m.

Coefficiente di altitudine $c_a = 1{,}00$

Velocità di riferimento $v_b = v_{b,0} \cdot c_a = 25{,}0 \times 1{,}00 = 25{,}0$ m/s

Vita nominale della costruzione $V_N = 50$ anni

Periodo di ritorno opera $T^*_{R,0} = 100$ anni – opera di rilevante importanza

Periodo di ritorno azione del vento $T_{R,0} = \max\{T^*_{R,0}, V_N\} = \max\{100, 100\} = 100$ anni

Coefficiente di ritorno $c_r = 0{,}65 \cdot \left\{1 - 0{,}138 \cdot \ln\left[-\ln\left(1 - \frac{1}{T_R}\right)\right]\right\} = 1{,}00$

Velocità di riferimento di progetto $v_r = v_b \cdot c_r = 25{,}0 \times 1{,}00 = 25{,}00$ m/s

Dati geometrici:

Altezza massima trave $h_{trave} = 3{,}80$ m

Spessore soletta $s_{soletta} = 0{,}25$ m

Spessore marciapiede $s_{mar.} = 0{,}15$ m

Spessore pavimentazione $s_{pav.} = 0{,}11$ m

Altezza carico stradale $h_{carico} = 3{,}00$ m

Altezza suolo-centro impalcato $z = 7{,}00$ m

Larghezza impalcato $d = 15{,}50$ m

5.6.3. Ponte scarico

Nel caso di ponte scarico si ottengono i seguenti valori:

Altezza investita $h_{tot} = h_{trave} + h_{soletta} + h_{mar.} + h_{barriera} = 3{,}80$ m

Quota di riferimento $z_r = z + \frac{h_{tot}}{2} = 8{,}90$ m

Rapporto geometrico $d/h_{tot} = 4{,}08$ m

Coefficiente di esposizione $c_e = k_r^2 \cdot \ln\left(\frac{z_r}{z_0}\right) \cdot c_t \cdot \left[\ln\left(\frac{z_r}{z_0}\right) \cdot c_t + 7\right] = 1{,}70$

Pressione di picco $$q_p = \frac{1}{2} \cdot \rho \cdot v_r^2 \cdot c_e = \frac{1}{2} \times 1{,}25 \times 25{,}00^2 \times 1{,}70 = 0{,}67 \text{ kN/m}^2$$

Azione finale	Valore	unità
Forza trasversale – F_X	3,65	kN/m
Forza longitudinale – F_Y	± 11,44	kN/m
Momento torcente – M_Z	± 32,00	kNm/m

Tabella 5.3: Azioni aerodinamiche ponte scarico secondo CNR-DT 207

La reazione sulla spalla vale:

$$H_{\text{vento ponte scarico}} = 3{,}65 \times 63{,}20/2 = 115{,}34 \text{ kN}$$

5.6.4. Ponte carico

Nel caso di ponte carico si ottengono i seguenti valori:

Altezza investita $$h_{tot} = h_{trave} + h_{soletta} + h_{mar.} + h_{barriera} = 4{,}25 \text{ m}$$

Quota di riferimento $$z_r = z + \frac{h_{tot}}{2} = 9{,}13 \text{ m}$$

Rapporto geometrico $$d/h_{tot} = 3{,}65 \text{ m}$$

Coefficiente di esposizione $$c_e = k_r^2 \cdot \ln\left(\frac{z_r}{z_0}\right) \cdot c_t \cdot \left[\ln\left(\frac{z_r}{z_0}\right) \cdot c_t + 7\right] = 1{,}72$$

Pressione di picco $$q_p = \frac{1}{2} \cdot \rho \cdot v_r^2 \cdot c_e = \frac{1}{2} \times 1{,}25 \times 25{,}00^2 \times 1{,}72 = 0{,}67 \text{ kN/m}^2$$

Azione finale	Valore	unità
Forza trasversale – F_X	4,24	kN/m
Forza longitudinale – F_Y	± 11,10	kN/m
Momento torcente – M_Z	± 32,31	kNm/m

Tabella 5.4: Azioni aerodinamiche ponte carico secondo CNR-DT 207

La reazione sulla spalla vale:

$$H_{\text{vento ponte carico}} = 4{,}24 \times 63{,}20/2 = 133{,}98 \text{ Kn}$$

5.7. RITIRO (ε_2)

Eurocodice 2 (EN 1992-1-1)

Nel programma di calcolo MIDAS CIVIL, utilizzato per modellare l'impalcato, il calcolo degli effetti reologici del calcestruzzo è effettuato secondo il modello CEB-FIB che corrisponde alle prescrizioni della norma europea EN 1992-1-1.

La procedura applicata alla costruzione per fasi si basa sul calcolo dei vari parametri in funzione del tempo.

La resistenza a compressione del calcestruzzo ad un età t dipende dal tipo di cemento, dalla temperatura e dalle condizioni di stagionatura. Per una temperatura media di 20°C e per la stagionatura in accordo con la EN 12390, la resistenza a compressione del calcestruzzo a diverse età $f_{cm}(t)$ si può stimare con le seguenti espressioni (EN1992-1-1 § 3.1.2):

$$f_{cm}(t) = \beta_{cc}(t) \cdot f_{cm}$$

$$\beta_{cc}(t) = \exp\left\{ s \cdot \left[1 - \left(\frac{28}{t} \right)^{1/2} \right] \right\}$$

dove:

$f_{cm}(t)$ resistenza media a compressione del calcestruzzo all'età di t giorni

f_{cm} resistenza media a compressione del calcestruzzo all'età di 28 giorni

$\beta_{cc}(t)$ coefficiente che dipende dall'età di t del calcestruzzo

t età del calcestruzzo in giorni

s coefficiente che dipende dal tipo di cemento
si assume pari a 0,25 per classi di resistenza CEM 32,5 R, CEM 42,5 N (Classe N)

La variazione del modulo di elasticità nel tempo si può stimare con le relazioni:

$$E_{cm}(t) = \left[\frac{f_{cm}(t)}{f_{cm}} \right]^{0,3} \cdot E_{cm}$$

$$E_{cm} = 22.000 \cdot \left[\frac{f_{cm}}{10} \right]^{0,3}$$

dove:

$f_{cm}(t)$ resistenza media a compressione del calcestruzzo all'età di t giorni

f_{cm} resistenza media a compressione del calcestruzzo all'età di 28 giorni

E_{cm} modulo elastico secante del calcestruzzo all'età di 28 giorni

Utilizzando la costruzione per fasi Midas Civil effettua un calcolo elastico della struttura, infatti viene calcolato il modulo elastico istantaneo al momento dell'applicazione del carico.
I valori inseriti nel modello per tale funzione sono i seguenti:
resistenza caratteristica media (f_{cm})

$$f_{cm} = f_{ck} + \Delta f \quad \Delta f = 8 \text{ N/mm}^2$$

Il ritiro e la viscosità sono funzione di semplici parametri quali:

- la resistenza caratteristica (f_{ck})
- umidità relativa (RH)
- dimensione nominale dell'elemento (h), pari a $h = \frac{2 \cdot A_c}{u}$
- il tipo di cemento utilizzato (s)
- l'età in cui inizia il ritiro

Ritiro

Per quanto riguarda il ritiro l'eurocodice 2 utilizza la seguente formula:

$$\varepsilon_{cs}(t, t_s) = [160 + 10 \cdot \beta_{sc} \cdot (9 - f_{cm})] \cdot 10^{-6} \cdot \beta_{RH} \cdot \left[\frac{t - t_s}{0{,}035 \cdot h^2 + t - t_s} \right]^{0,5}$$

dove:

β_{sc} è il coefficiente che dipende dal tipo di cemento:

- 4 per cementi a indurimento lento, SL;
- 5 per cementi normali o a rapido indurimento, N,R;
- 8 per cementi a rapido indurimento ed alta resistenza, RS.

β_{RH} è definito come:

$$\beta_{RH} = \begin{cases} -1{,}55 \cdot \beta_{sRH} & per \ 40\% \leq RH \leq 99\% \\ +0{,}25 & per \ RH > 99\% \end{cases}$$

con

$$\beta_{sRH} = 1 - \left[\frac{RH}{100} \right]^3$$

Si riporta di seguito il grafico dell'andamento del coefficiente di ritiro in funzione del tempo utilizzato per i calcoli delle vari fasi di costruzione del ponte.

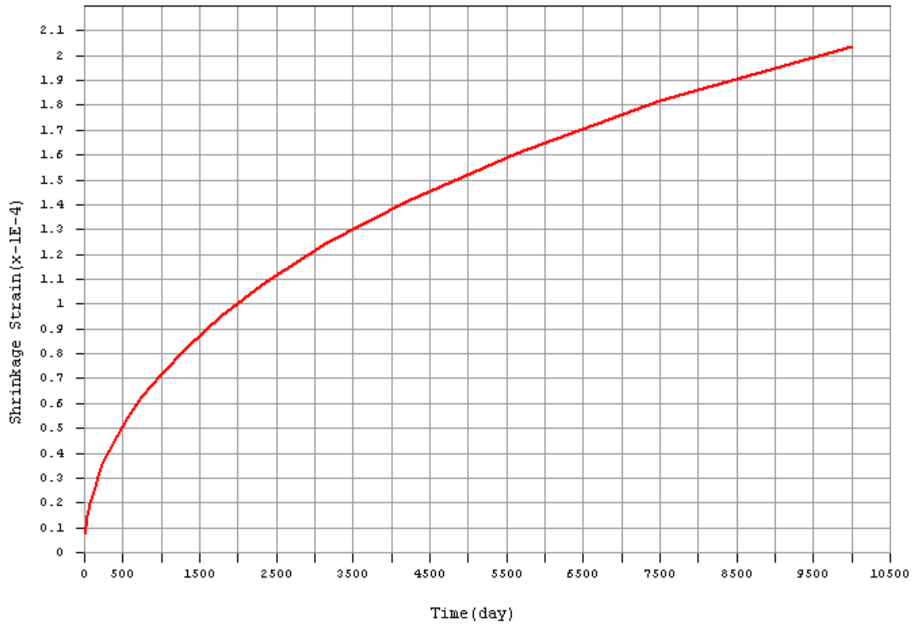


Figura 5.4 : Andamento del coefficiente di ritiro

Viscosità

Per quanto riguarda la viscosità l'eurocodice 2 utilizza la seguente formula:

$$\phi(t,t_0) = \left[1 + \frac{1 - RH/100}{0{,}10 \cdot \sqrt[3]{h}}\right] \cdot \frac{16{,}8}{\sqrt{f_{cm}}} \cdot \frac{1}{0{,}1 + (t_0)^{0{,}20}} \cdot \left[\frac{(t - t_0)}{\beta_H + t - t_0}\right]^{0{,}3}$$

dove:

β_H è definito come:

$$\beta_H = 1{,}5 - \left[1 + (0{,}012 \cdot RH)^{18}\right] \cdot h + 250 \leq 1500$$

Si riporta di seguito il grafico dell'andamento del coefficiente di viscosità in funzione del tempo utilizzato per i calcoli delle vari fasi di costruzione del ponte.

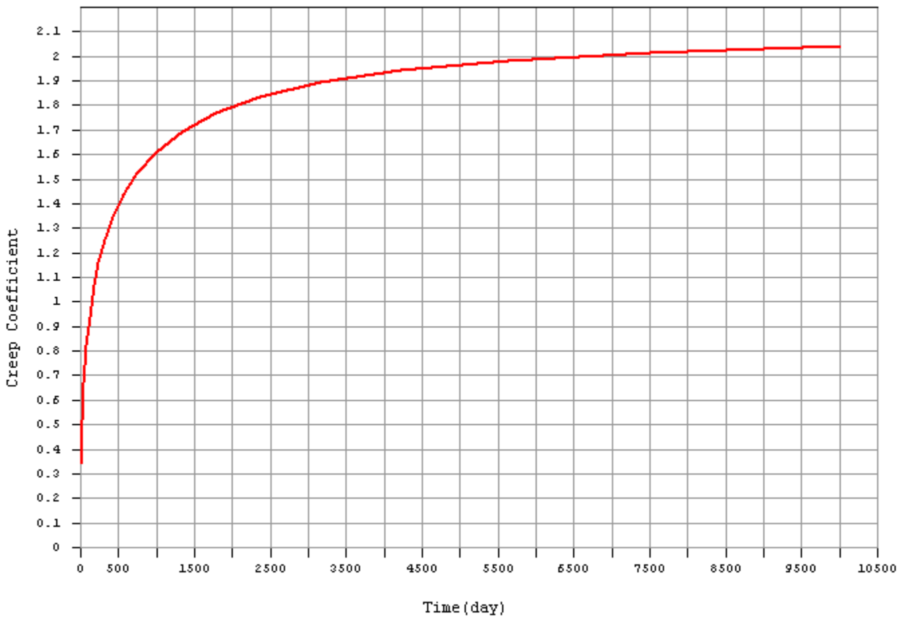


Figura 5.5 : Andamento del coefficiente di viscosità

5.8. VARIAZIONE TERMICA (ε_3)

In base al D.M. 14 gennaio 2008 “Norme tecniche per le costruzioni” si tiene conto della variazione termica considerando un ΔT = ±25°C uniforme.

Quindi la variazione di lunghezza dell’impalcato vale:

$\Delta l = \alpha \cdot \Delta T \cdot L = 1{,}20 \times 10^{-5} \times 25 \times 63.200 = 18{,}96$ mm

Per il calcolo delle escursione totale del giunto si considera la tipologia di appoggi di tipo elastomerico con un appoggio fisso e quindi libertà di movimento longitudinale su un solo lato. Si incrementa la variazione di temperatura del 50%.

$\Delta l_{giunto,tot} = 1{,}5 \cdot (\Delta l) = 1{,}5 \times 18{,}96 = 28{,}44$ mm

Per il giunto tra impalcato e spalla si adotta una tipologia con una escursione di $\Delta l_{giunto} = \pm 50{,}0$ mm

6. ANALISI IMPALCATO

L'impalcato del viadotto è stato analizzato attraverso un modello FEM con l'ausilio del programma di calcolo MIDAS CIVIL 2012. Si riporta di seguito l'analisi dell'impalcato.

6.1. DEFINIZIONE DEL MODELLO

Il modello di calcolo è costituito dai seguenti elementi:

- nodi 112
- elementi 200

Le due travi principali sono definite mediante 40 elementi *beam* ciascuna. Per ogni elemento è stato definito un concio modello in relazione delle dimensioni geometriche.
I traversi, in struttura mista acciaio calcestruzzo, sono distinti tra traversi di spalle e traversi tipo intermedi.

6.2. FASI DI COSTRUZIONE

Nel modello si sono considerate le seguenti fasi di costruzione:

FASE	DURATA	TEMPO
F01 – Posa carpenteria metallica	10 giorni	10 giorni
F02 – Getto soletta	5 giorni	25 giorni
F03 – Permanenti	10 giorni	1000 giorni

Tabella 6.1: Modello – Fasi di costruzione

Nelle figure successive si riportano le fasi di costruzione analizzate.

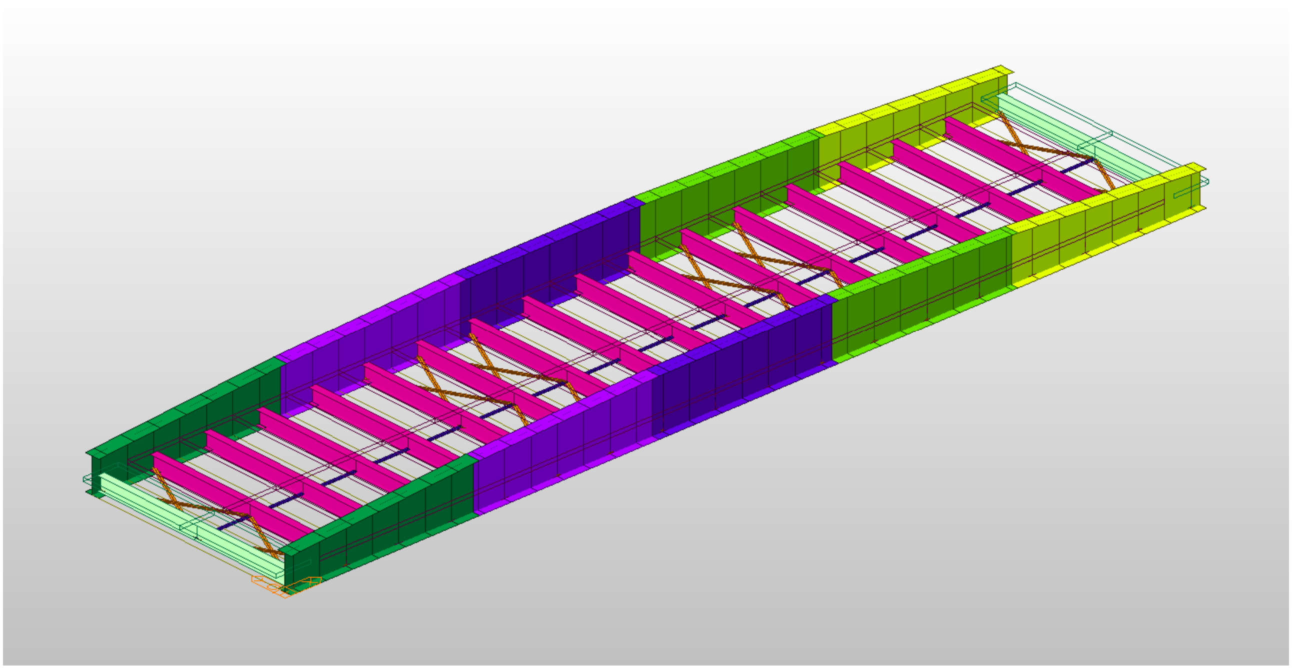


Figura 6.1 : Vista isometrica Modello

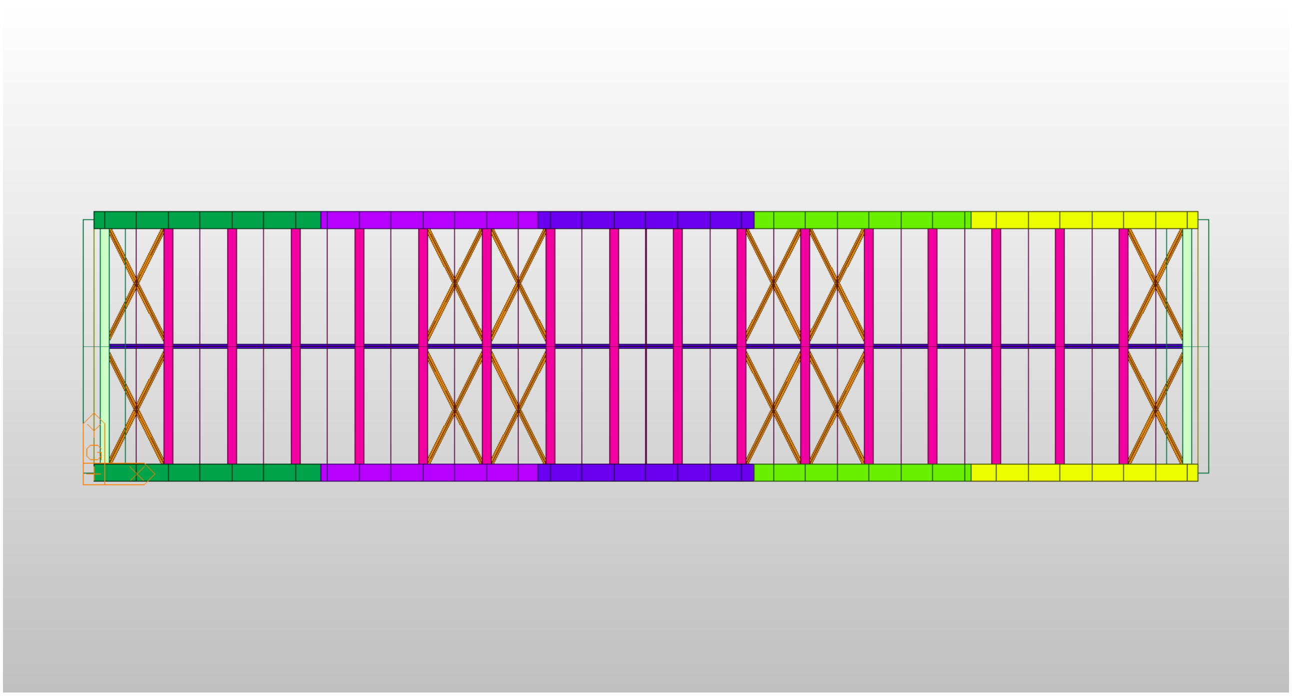


Figura 6.2 : Vista in pianta Modello

6.3. LARGHEZZA COLLABORANTE DELLA SOLETTA

La distribuzione delle tensioni normali negli elementi composti, deve essere determinata utilizzando nel calcolo la larghezza efficace della soletta.

La larghezza efficace, b_{eff}, di una soletta in calcestruzzo è determinata mediante l'espressione:

$$b_{eff} = b_0 + b_{e1} + b_{e2}$$

dove b_0 è la distanza tra gli assi dei connettori e b_{e1} è il valore della larghezza collaborante da ciascun lato della sezione composta determinata con:

$$b_{ei} = \min\left(\frac{L_e}{8}, b_i - \frac{b_0}{2}\right)$$

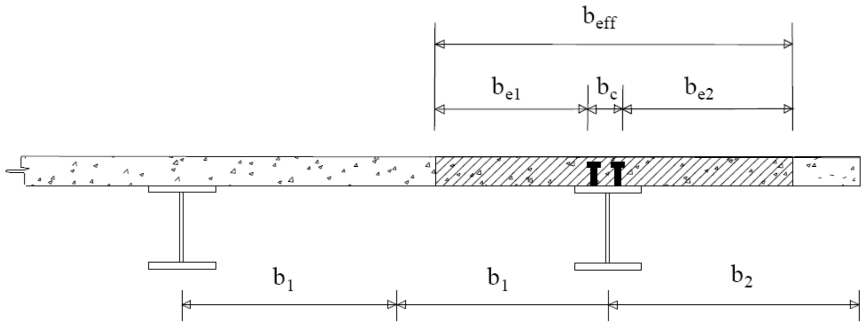


Figura 6.3 : Definizione della larghezza efficace b_{eff} e delle aliquote b_{ei}

Per gli appoggi di estremità la formula diviene:

$$b_{eff} = b_0 + \beta_1 b_{e1} + \beta_2 b_{e2}$$

dove

$$\beta_i = \left(0{,}55 + 0{,}025 \cdot \frac{L_e}{b_{ei}}\right) \leq 1{,}0$$

La lunghezza L_e è individuata in funzione della posizione sulla trave dalla figura 6.4 Per gli appoggi di estremità è pari al valore della luce della prima campata.

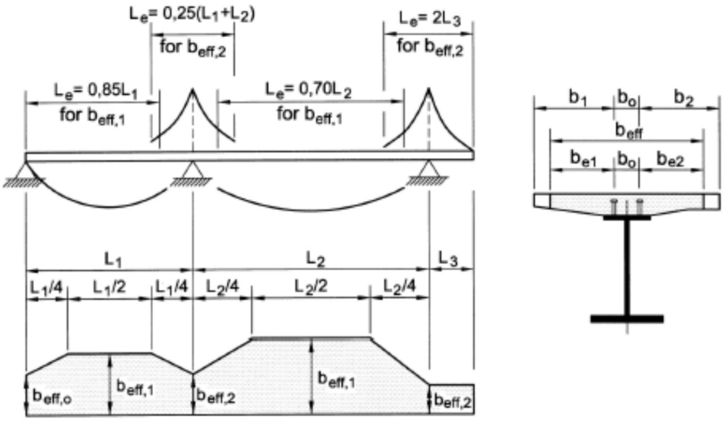


Figura 6.4 : Larghezza efficace, b_{eff}, e luci equivalenti, L_e, per travi continue

6.4. CARATTERISTICHE INERZIALI

L'impalcato è costituito da due travi in acciaio di altezza variabile da un minimo di 2,40 m a 3,60 m, collegate tra loro da traversi di altezza 0,90 m su cui poggia una soletta in C.A. di spessore 0,25 m. Le travi principali hanno le seguenti caratteristiche geometriche:

Concio A

- Altezza variabile da 2400 mm a 3316 mm
- Piattabanda superiore larghezza 1000 mm sp 80 mm
- Piattabanda inferiore larghezza 1000 mm sp 80 mm
- Spessore anima 20 mm

Concio B

- Altezza variabile da 3316 mm a 3600 mm
- Piattabanda superiore larghezza 1000 mm sp 100 mm
- Piattabanda inferiore larghezza 1000 mm sp 100 mm
- Spessore anima 22 mm

Concio C

- Altezza 3600 mm
- Piattabanda superiore larghezza 1000 mm sp 100 mm
- Piattabanda inferiore larghezza 1000 mm sp 100 mm
- Spessore anima 24 mm

Traverso di spalla

- Altezza 900 mm
- Piattabanda superiore larghezza 500 mm sp 40 mm
- Piattabanda inferiore larghezza 500 mm sp 40 mm
- Spessore anima 20 mm

Traversi intermedi

- Altezza 900 mm
- Piattabanda superiore larghezza 500 mm sp 25 mm
- Piattabanda inferiore larghezza 500 mm sp 35 mm
- Spessore anima 16 mm

Controventi di montaggio

- 2 angolari 100 x 100 x 8 mm

Rompitratta longitudinale

- 2 angolari 100 x 100 x 8 mm

Le valutazioni delle caratteristiche inerziali di calcolo sono state eseguite con il programma calcolo Midas Civil, specifico per l'analisi di sezioni in acciaio e in struttura mista acciaio-calcestruzzo.
Di seguito sono riportate le tabelle riepilogative delle caratteristiche dei conci di calcolo del modello.
Nelle tabelle sono considerate due fasi:

- Solo struttura metallica - Before Composite

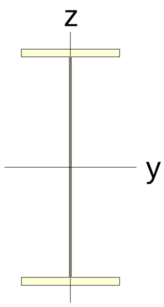
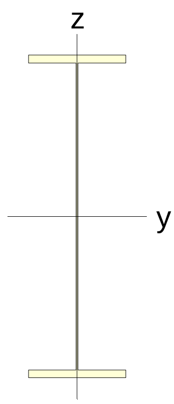
- Struttura composta a tempo t=0 - After Composite

Per una migliore comprensione dei dati in tabella 6.2 è riportata la leggenda delle caratteristiche inerziali dei conci di calcolo.

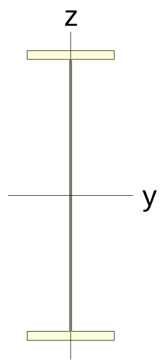
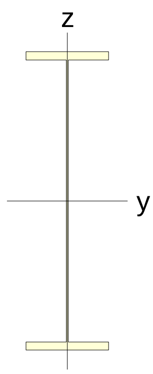
A(cm^2)	Asy(cm^2)	Asz(cm^2)	z(+)(cm)	z(-)(cm)
Area della sezione	Area effettiva di taglio *asse orizzontale*	Area effettiva di taglio *asse verticale*	Distanza tra il baricentro della sezione e l'estremo superiore *asse verticale*	Distanza tra il baricentro della sezione e l'estremo inferiore *asse verticale*
Ixx(cm^4)	Iyy(cm^4)	Izz(cm^4)	y(+)(cm)	y(-)(cm)
Momento d'inerzia torsionale	Momento d'inerzia *asse orizzontale*	Momento d'inerzia *asse verticale*	Distanza tra il baricentro della sezione e l'estremo laterale *asse orizzontale*	Distanza tra il baricentro della sezione e l'estremo laterale *asse orizzontale*
Es/Ec	Gs/Gc	Ds/Dc	Ps	Pc
Rapporto tra moduli elastici longitudinali Acciaio/Calcestruzzo	Rapporto tra moduli elastici tangenziali Acciaio/Calcestruzzo	Rapporto tra le densità Acciaio/Calcestruzzo	Coeff. di Poisson Acciaio	Coeff. di Poisson Calcestruzzo

Tabella 6.2: Leggenda dati delle caratteristiche inerziali

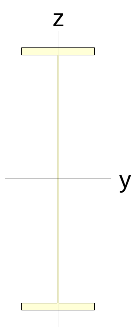
Concio A

I-End					**J-End**				
									
A(cm^2)	Asy(cm^2)	Asz(cm^2)	z(+)(cm)	z(-)(cm)	A(cm^2)	Asy(cm^2)	Asz(cm^2)	z(+)(cm)	z(-)(cm)
2048.000	1333.333	480.000	120.000	120.000	2231.200	1333.333	663.200	165.800	165.800
Ixx(cm^4)	Iyy(cm^4)	Izz(cm^4)	y(+)(cm)	y(-)(cm)	Ixx(cm^4)	Iyy(cm^4)	Izz(cm^4)	y(+)(cm)	y(-)(cm)
34752.000	23411370.667	1333482.667	50.000	50.000	34996.267	47134454.069	1333543.733	50.000	50.000

Concio B

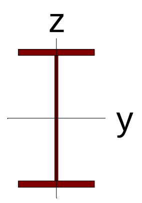
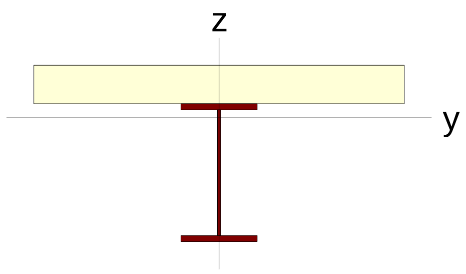
I-End					J-End				
									
A(cm^2)	Asy(cm^2)	Asz(cm^2)	z(+)(cm)	z(-)(cm)	A(cm^2)	Asy(cm^2)	Asz(cm^2)	z(+)(cm)	z(-)(cm)
2685.520	1666.667	729.520	165.800	165.800	2748.000	1666.667	792.000	180.000	180.000
Ixx(cm^4)	Iyy(cm^4)	Izz(cm^4)	y(+)(cm)	y(-)(cm)	Ixx(cm^4)	Iyy(cm^4)	Izz(cm^4)	y(+)(cm)	y(-)(cm)
67808.132	57276635.231	1666943.160	50.000	50.000	67908.933	68472400.000	1666968.360	50.000	50.000

Concio C

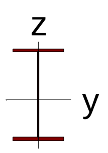
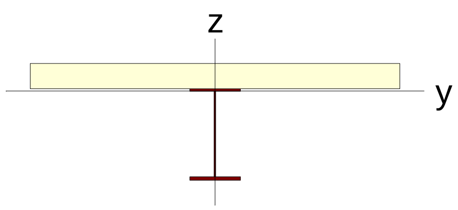


A(cm^2)	Asy(cm^2)	Asz(cm^2)	z(+)(cm)	z(-)(cm)
2816.000	1666.667	864.000	180.000	180.000
Ixx(cm^4)	Iyy(cm^4)	Izz(cm^4)	y(+)(cm)	y(-)(cm)
68279.467	69127466.667	1667058.347	50.000	50.000

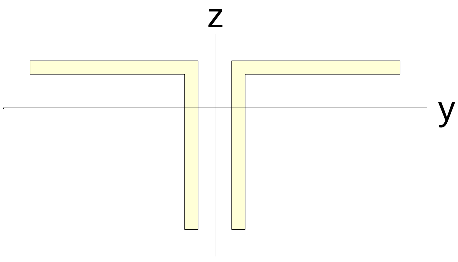
Traversi su spalle

Before Composite					After Composite				
									
A(cm^2)	Asy(cm^2)	Asz(cm^2)	z(+)(cm)	z(-)(cm)	A(cm^2)	Asy(cm^2)	Asz(cm^2)	z(+)(cm)	z(-)(cm)
564.000	336.103	170.049	45.000	45.000	1496.124	1171.405	170.402	9.176	80.824
Ixx(cm^4)	Iyy(cm^4)	Izz(cm^4)	y(+)(cm)	y(-)(cm)	Ixx(cm^4)	Iyy(cm^4)	Izz(cm^4)	y(+)(cm)	y(-)(cm)
2362.667	832028.000	83388.000	25.000	25.000	107550.270	2042348.089	4645631.773	25.000	25.000
-	-	-	-	-	Es/Ec	Gs/Gc	Ds/Dc	Ps	Pc
-	-	-	-	-	6.500	6.000	3.079	0.300	0.200

Traversi intermedi

Before Composite					After Composite				
									
A(cm^2)	Asy(cm^2)	Asz(cm^2)	z(+)(cm)	z(-)(cm)	A(cm^2)	Asy(cm^2)	Asz(cm^2)	z(+)(cm)	z(-)(cm)
434.400	252.120	136.254	49.680	40.320	1837.105	1514.330	136.360	2.203	87.797
Ixx(cm^4)	Iyy(cm^4)	Izz(cm^4)	y(+)(cm)	y(-)(cm)	Ixx(cm^4)	Iyy(cm^4)	Izz(cm^4)	y(+)(cm)	y(-)(cm)
1093.784	636398.194	62528.672	25.000	25.000	159385.176	1991837.905	15609890.463	25.000	25.000
-	-	-	-	-	Es/Ec	Gs/Gc	Ds/Dc	Ps	Pc
-	-	-	-	-	6.500	6.000	3.079	0.300	0.200

Controventi



A(cm^2)	Asy(cm^2)	Asz(cm^2)	z(+)(cm)	z(-)(cm)
30.720	13.333	13.333	2.796	7.204
Ixx(cm^4)	Iyy(cm^4)	Izz(cm^4)	y(+)(cm)	y(-)(cm)
6.554	296.345	738.970	11.000	11.000

6.5. AZIONI SULLE TRAVI PRINCIPALI

Le travi principali in acciaio, dal momento della loro posa in opera alla loro fase di massimo carico in esercizio, incontrano diverse fasi successive:

FASE
F01 – Travi
F02 – Getto soletta
F03 – Permanenti
F04 – Ritiro
F05 – Carichi da traffico

Tabella 6.3: Fasi di carico

Nelle figure successive si riportano i diagrammi del momento flettente e del taglio per le combinazioni di massimo distinte per singoli conci della travatura principale e per i traversi. Si riporta inoltre la mappatura delle reazioni massime per le combinazioni SLE rara e quasi permanente, la deformazione massima in combinazione SLE rara e quasi permanente e quindi le tensioni massime per i conci della travatura principale e per i due traversi tipo di spalla e intermedi.

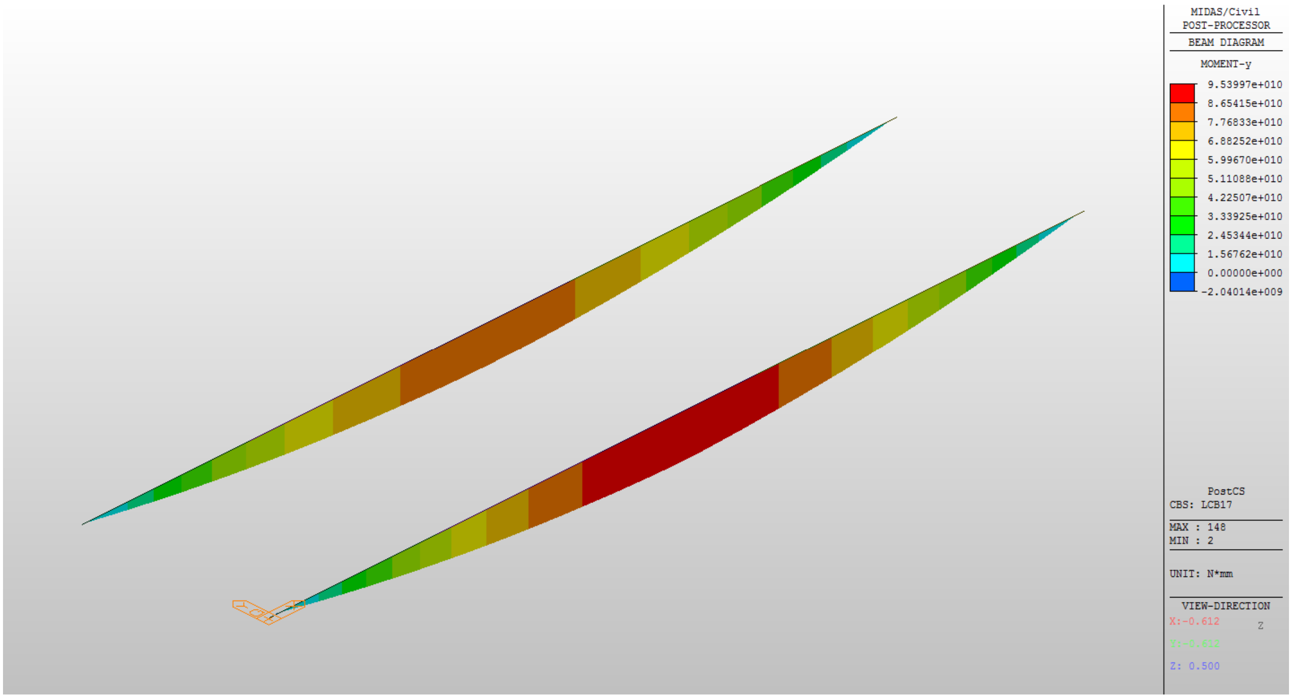


Figura 6.5 : Momento flettente massimo mezzeria concio C - SLU (kN/m)

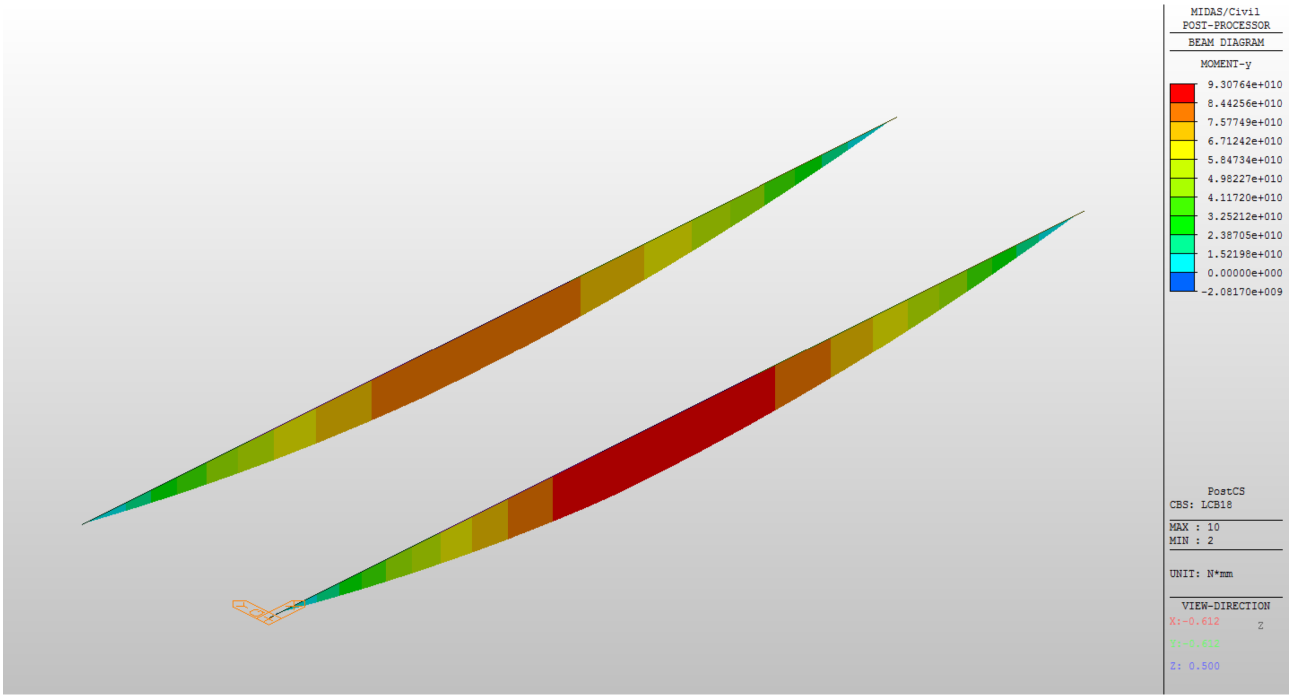


Figura 6.6 : Momento flettente massimo mezzeria concio B - SLU (kN/m)

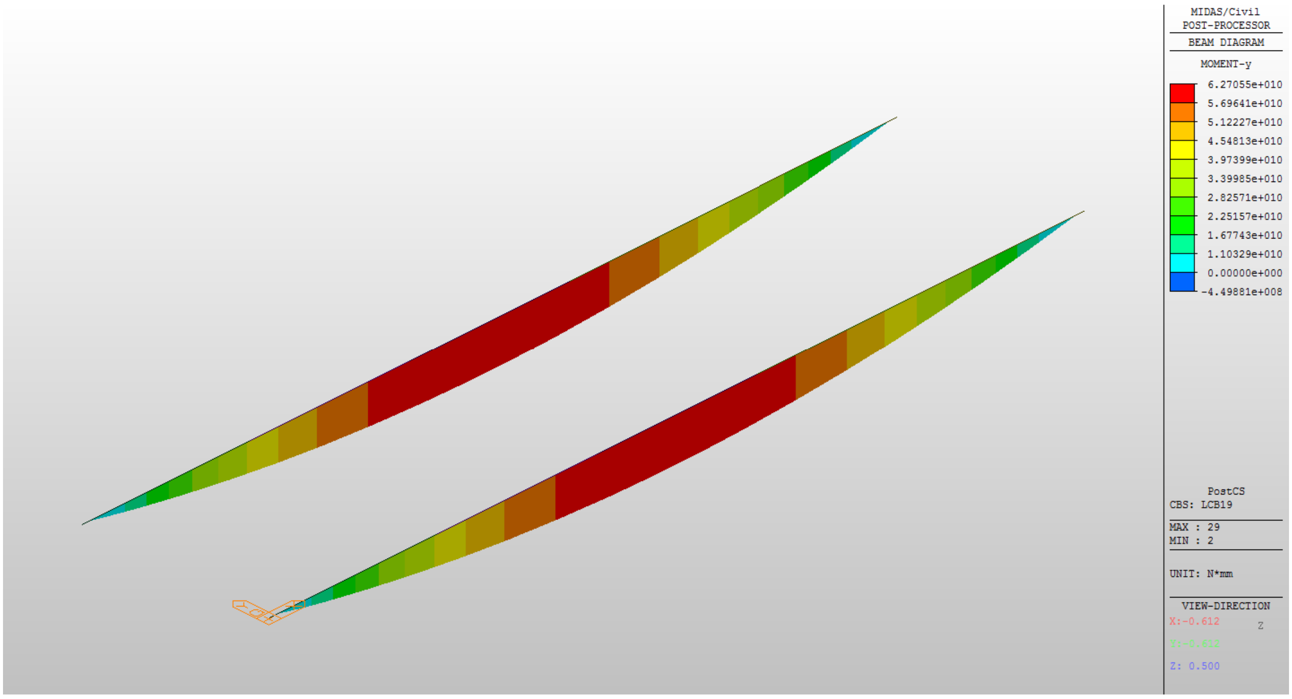


Figura 6.7 : Momento flettente massimo mezzeria concio A - SLU (kN/m)

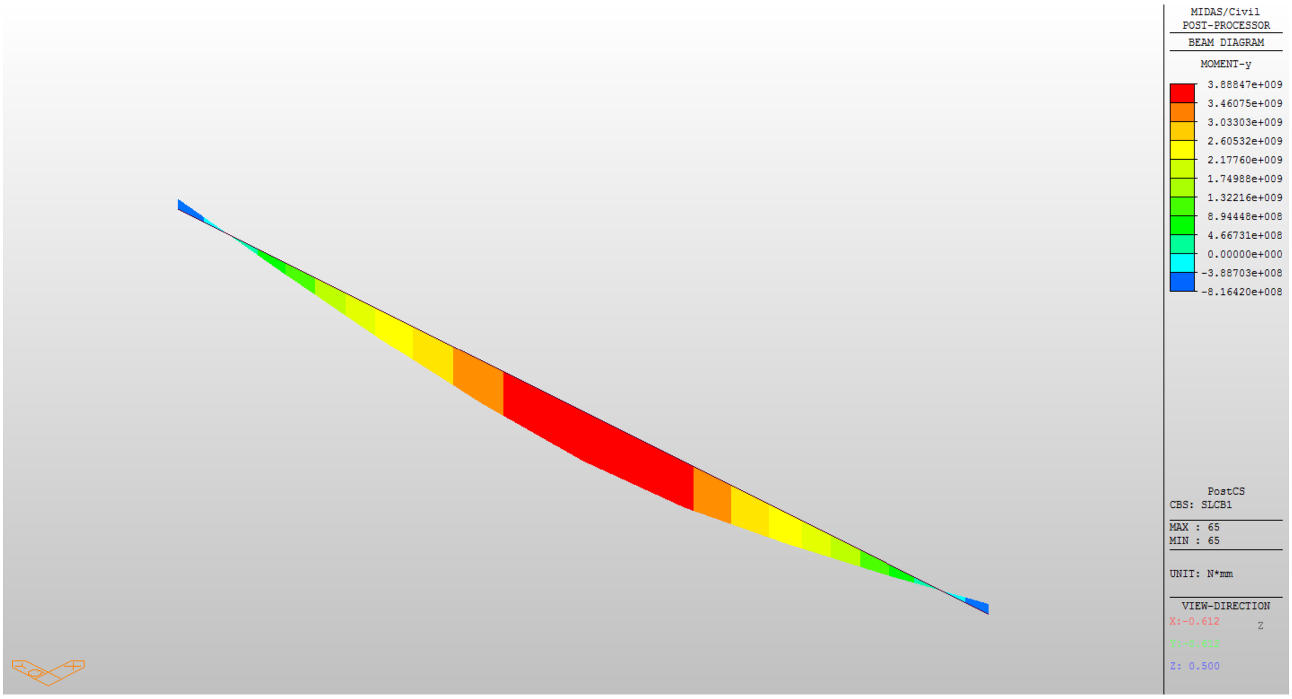


Figura 6.8 : Momento flettente massimo traverso tipo - SLU (kN/m)

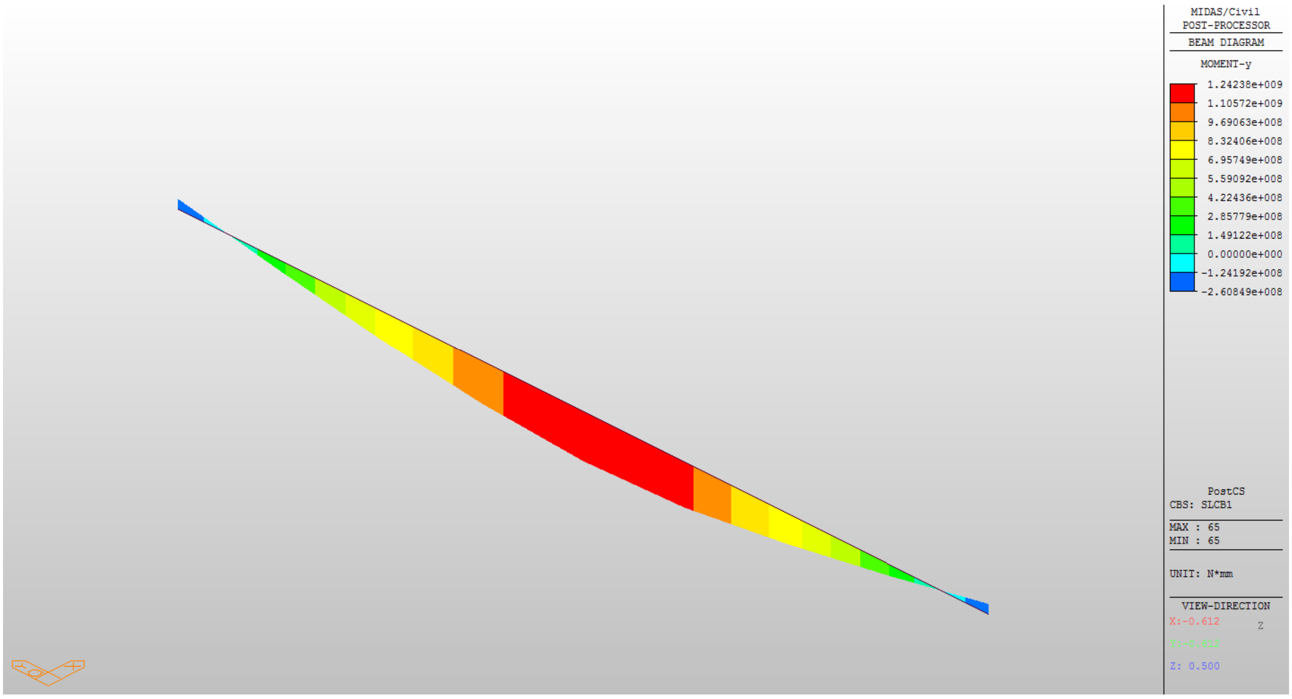


Figura 6.9 : Momento flettente massimo traverso tipo parte acciaio - SLU (kN/m)

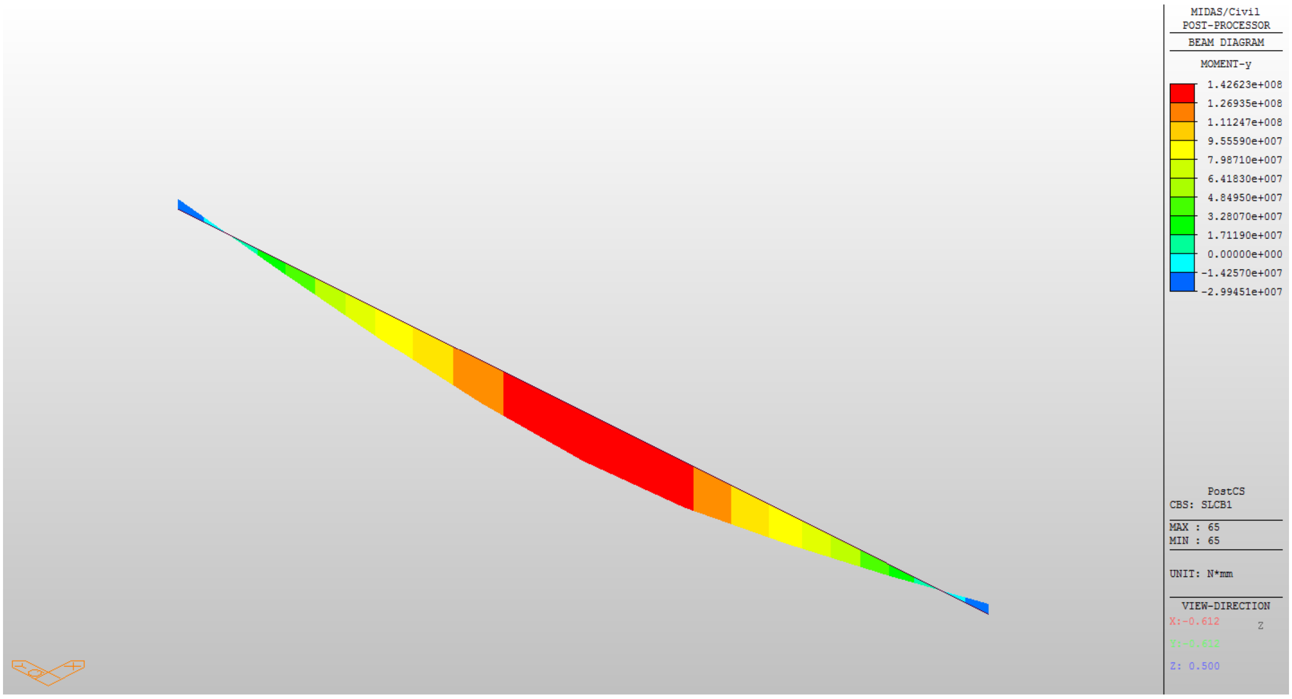


Figura 6.10 : Momento flettente massimo traverso tipo parte calcestruzzo - SLU (kN/m)

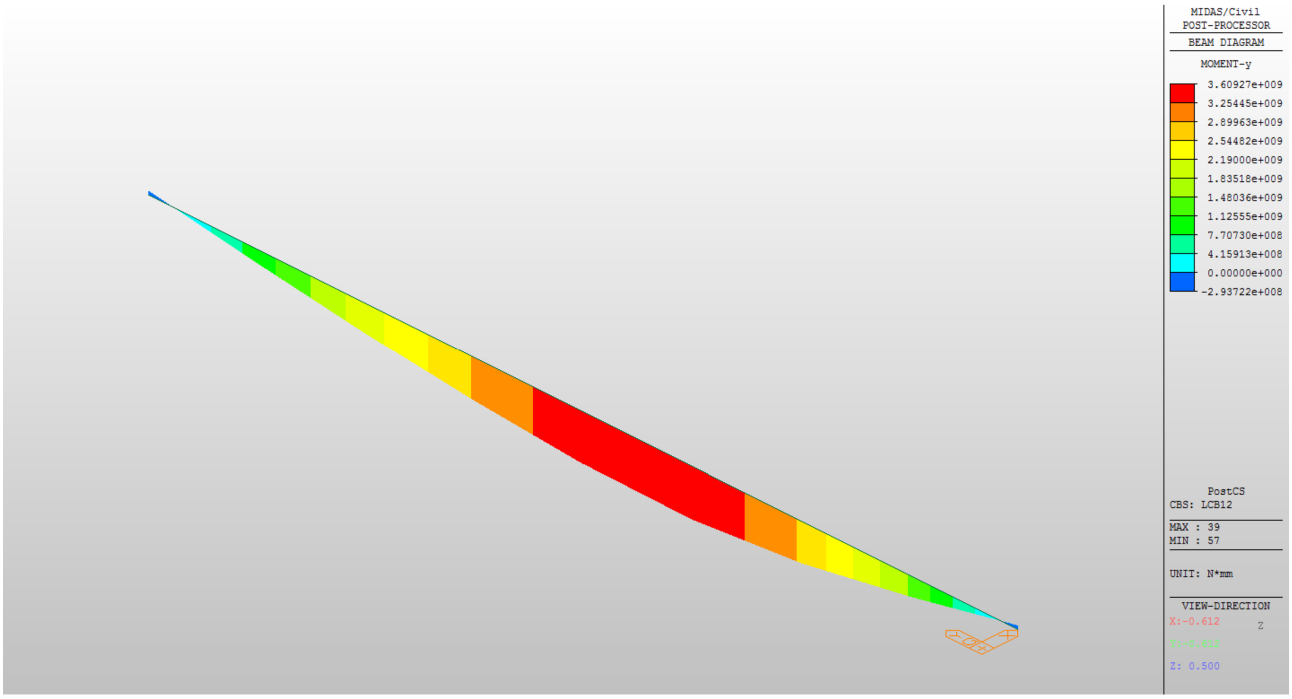


Figura 6.11 : Momento flettente massimo traverso di spalla - SLU (kN/m)

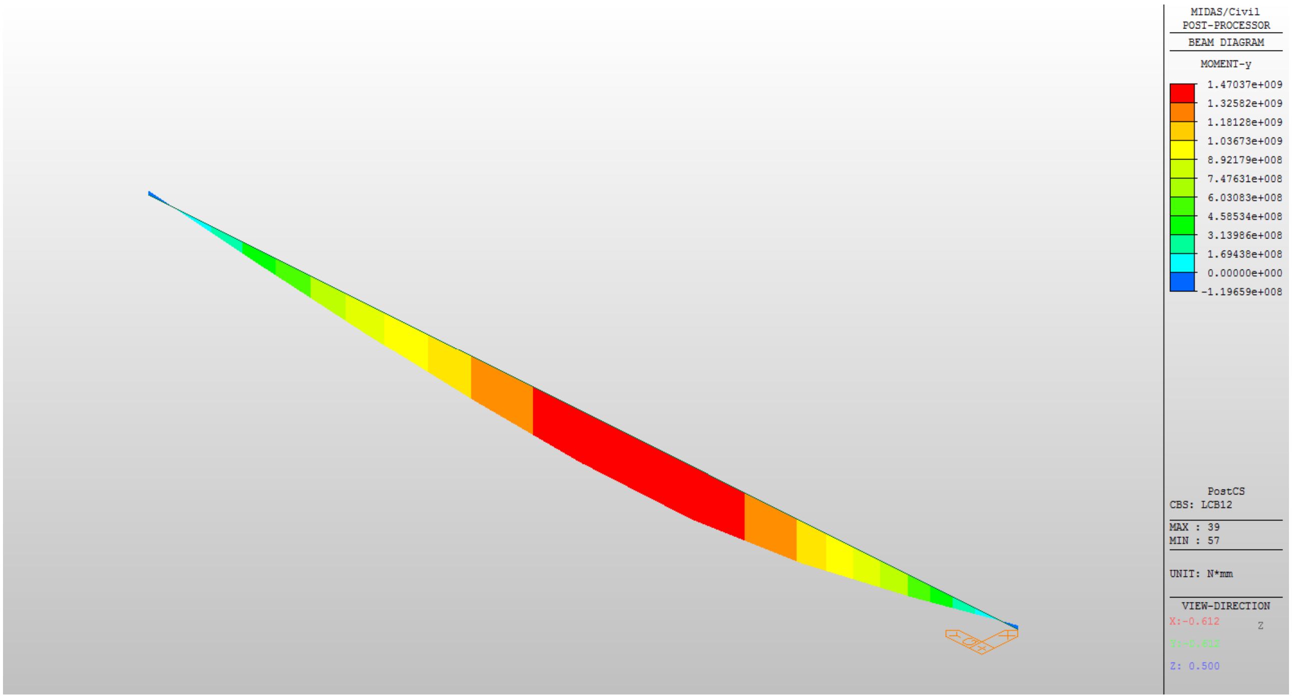


Figura 6.12 : Momento flettente massimo traverso di spalla parte acciaio - SLU (kN/m)

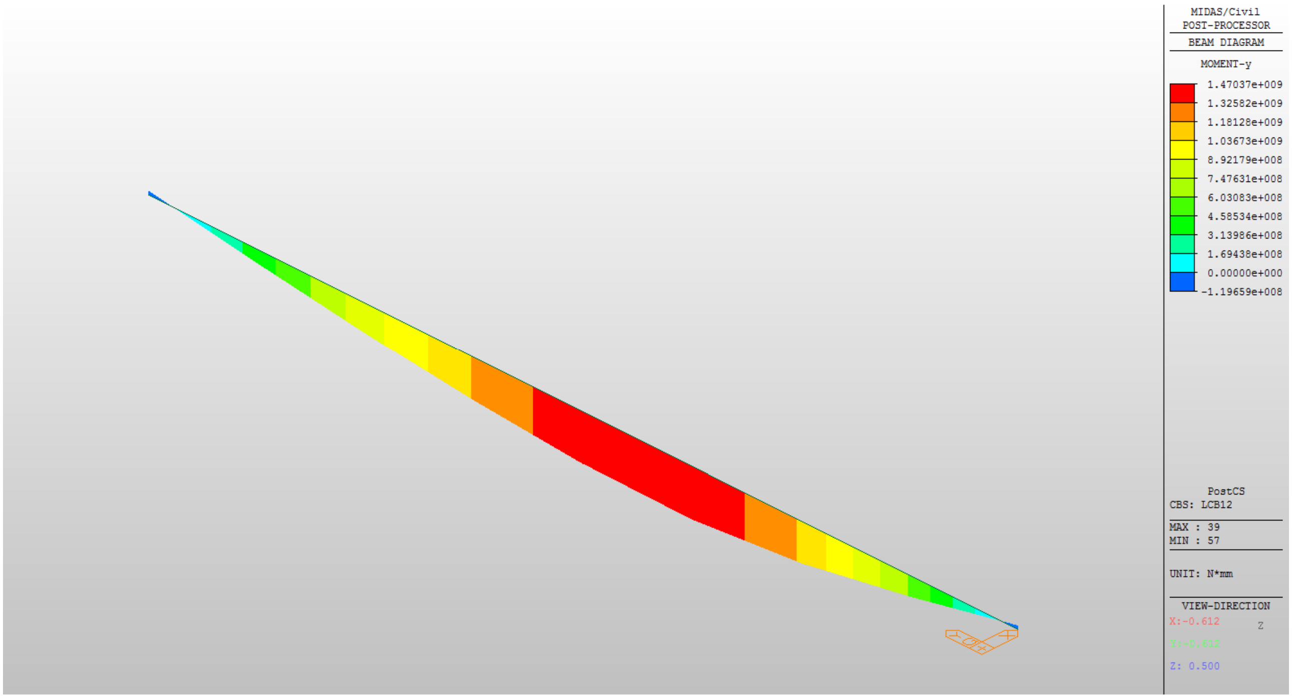


Figura 6.13 : Momento flettente massimo traverso di spalla parte calcestruzzo (kN/m)

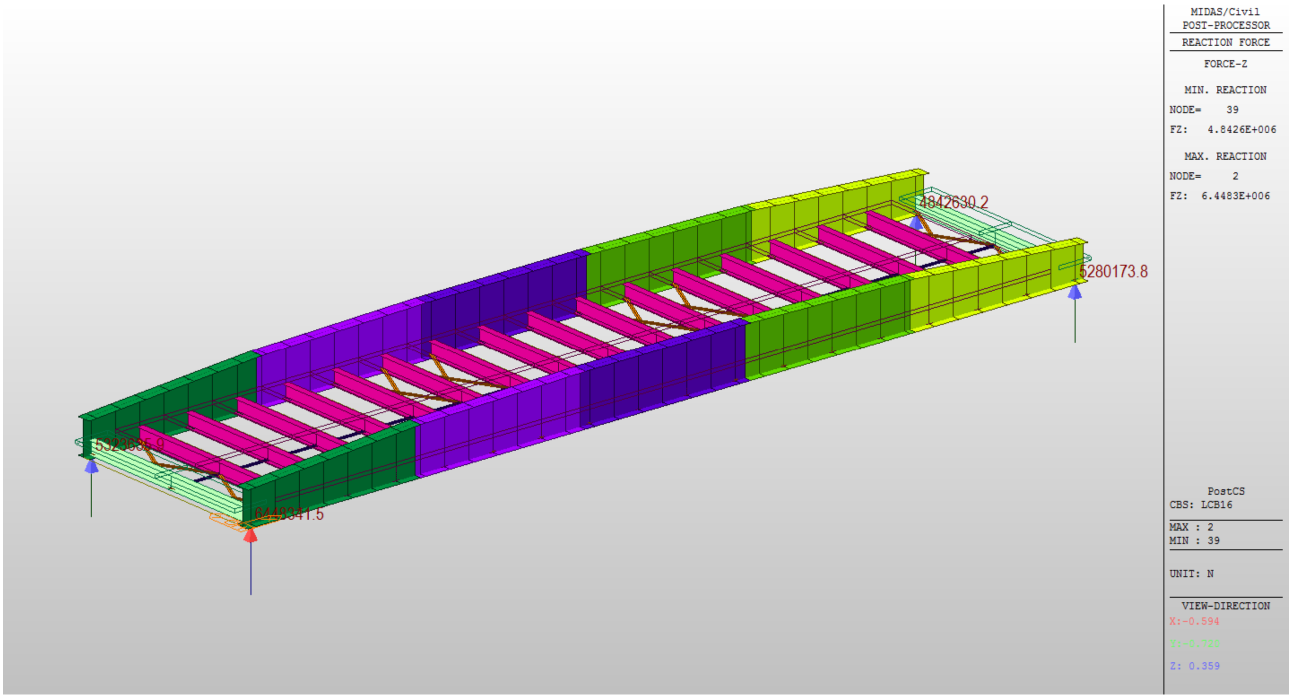


Figura 6.14 : Reazione massima - SLU (kN)

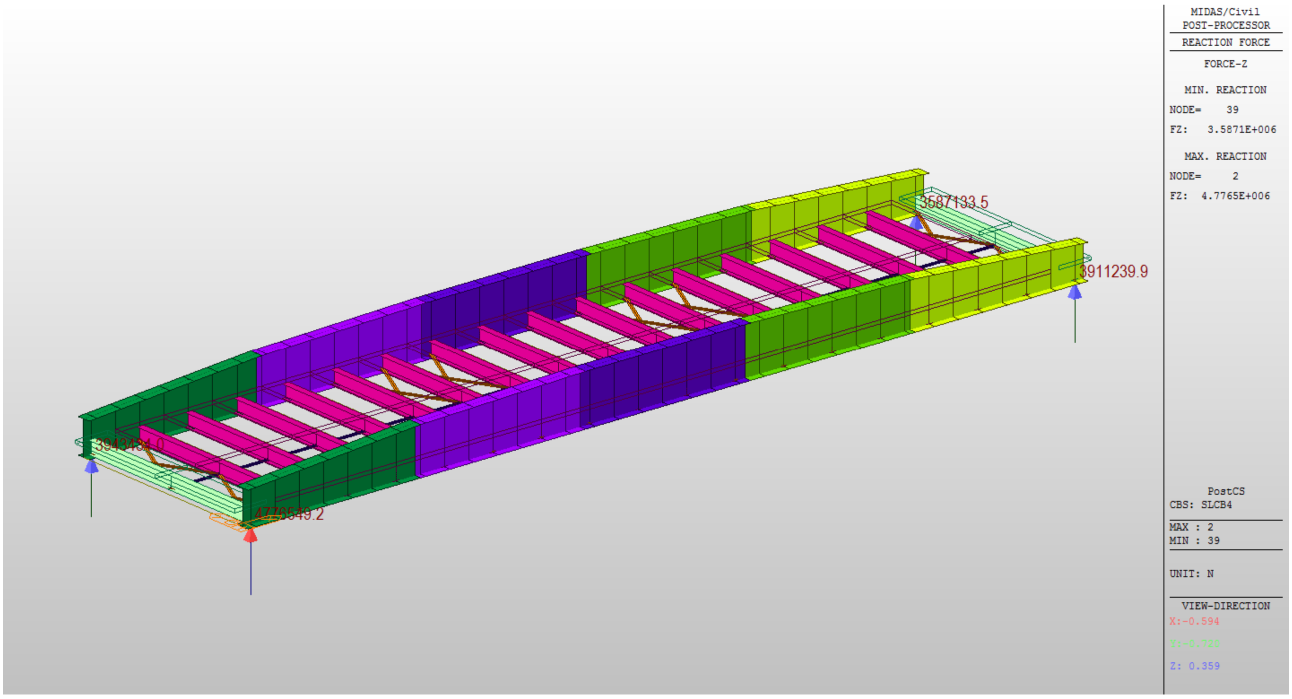


Figura 6.15 : Reazione massima - SLE (kN)

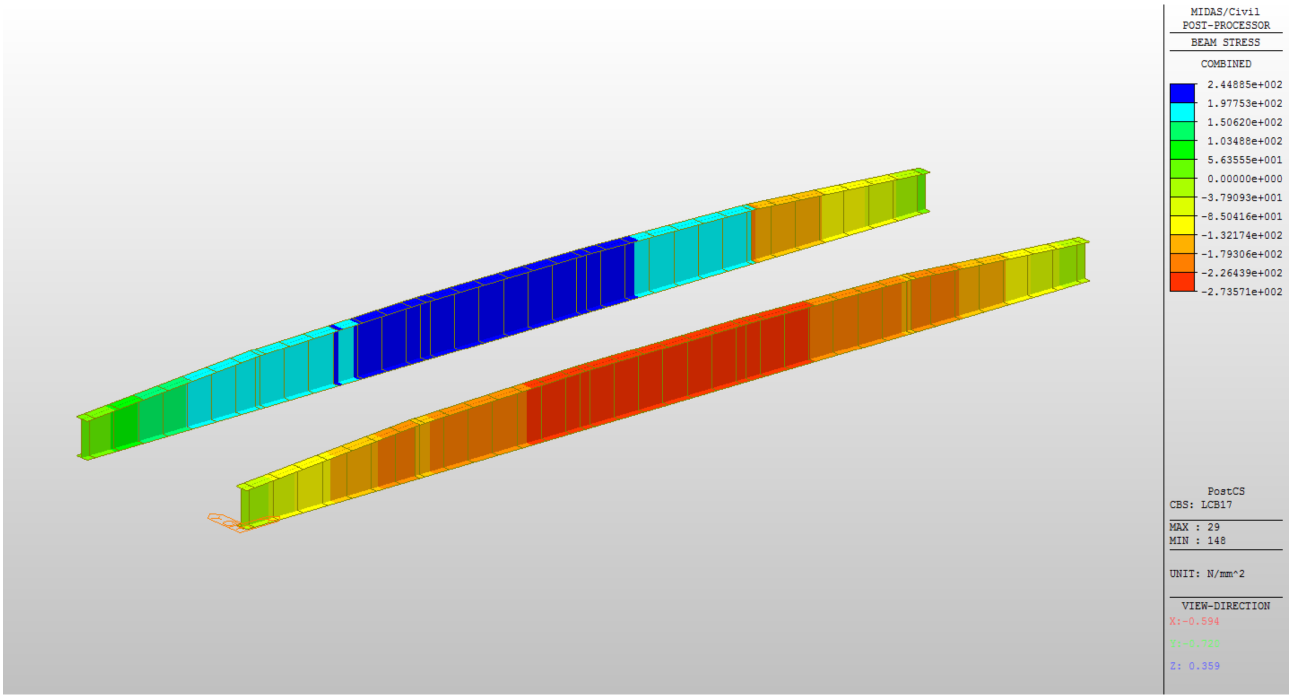


Figura 6.16 : Tensione massima concio C - SLU (N/mm^2)

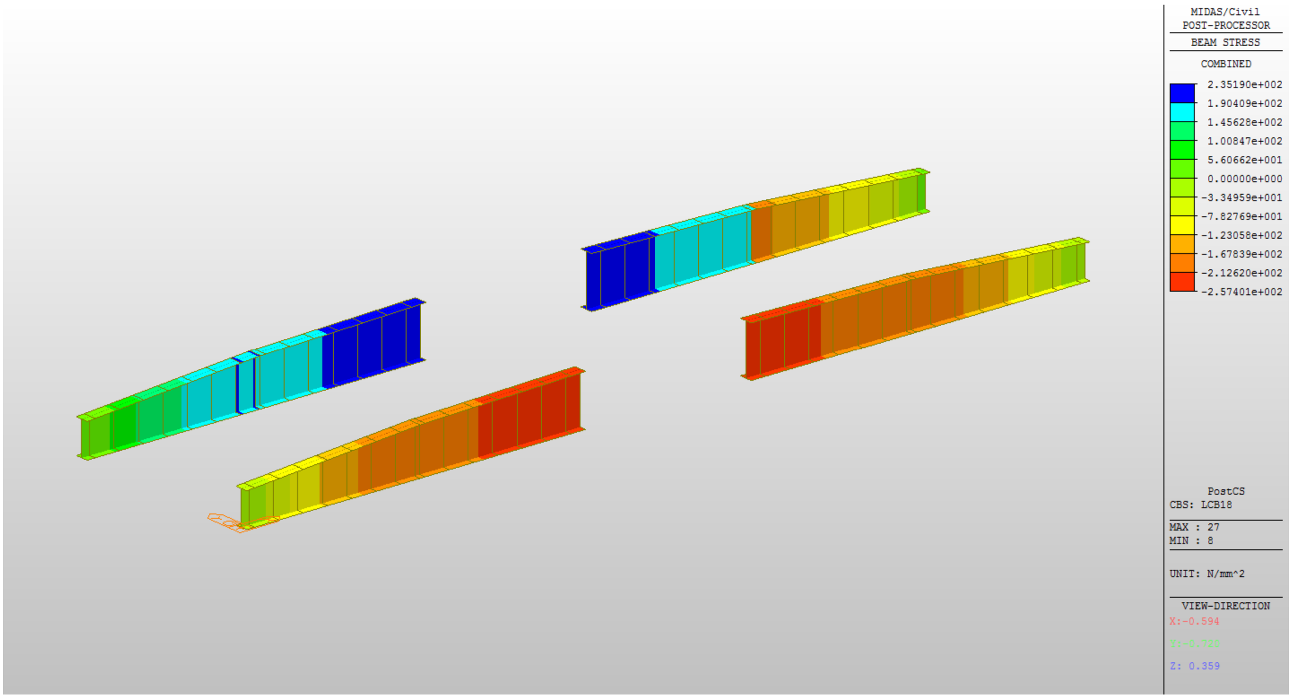


Figura 6.17 : Tensione massima concio B - SLU (N/mm^2)

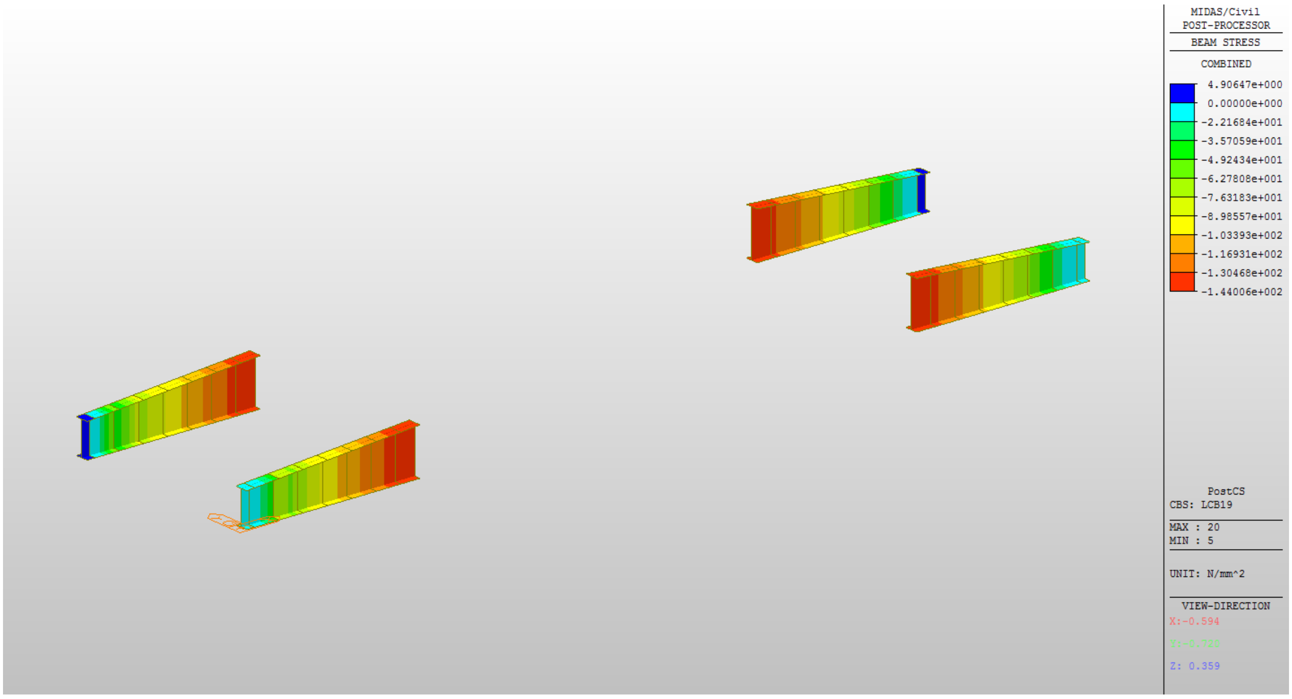


Figura 6.18 : Tensione massima concio A - SLU (N/mm^2)

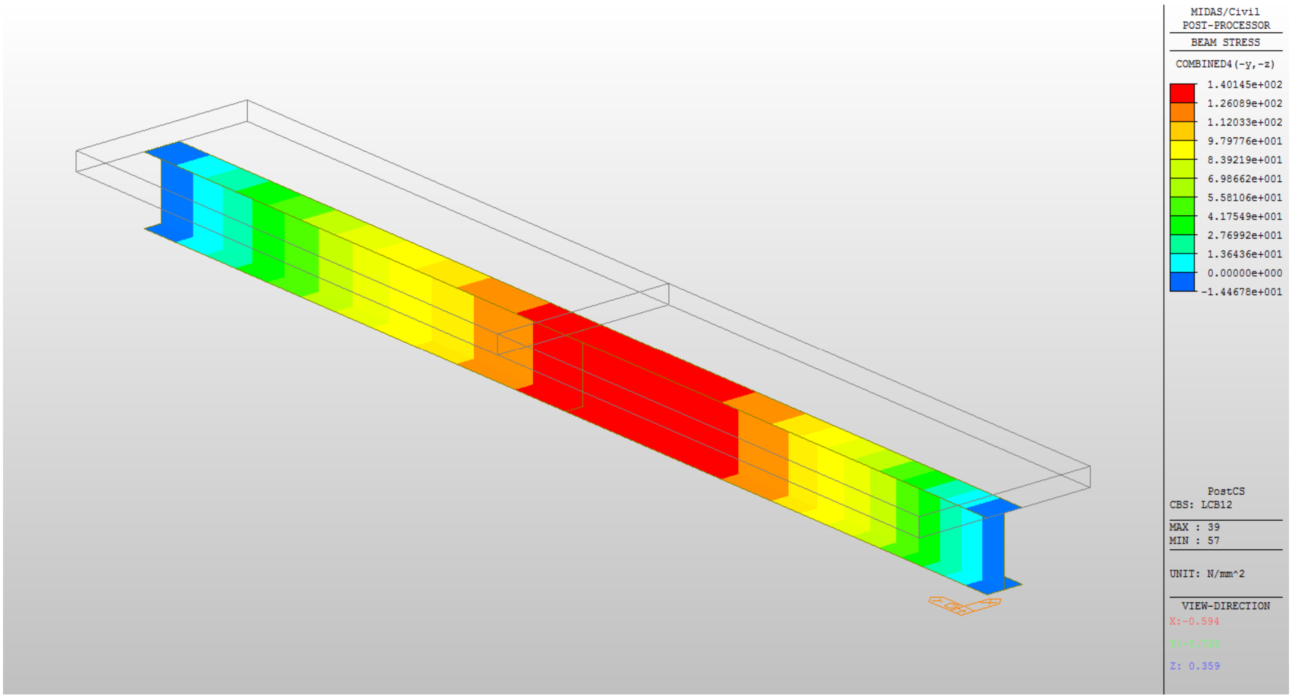


Figura 6.19 : Tensione massima traverso spalla parte acciaio - SLU (N/mm^2)

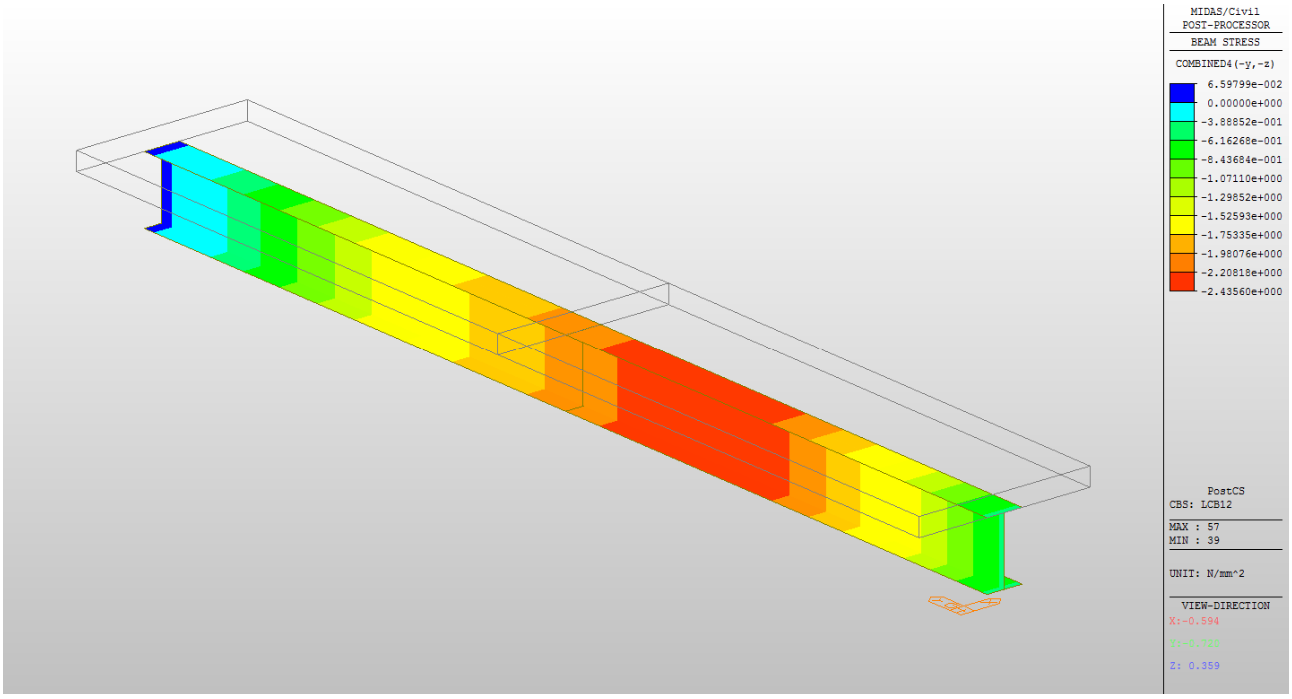


Figura 6.20 : Tensione massima traverso spalla parte calcestruzzo - SLU (N/mm^2)

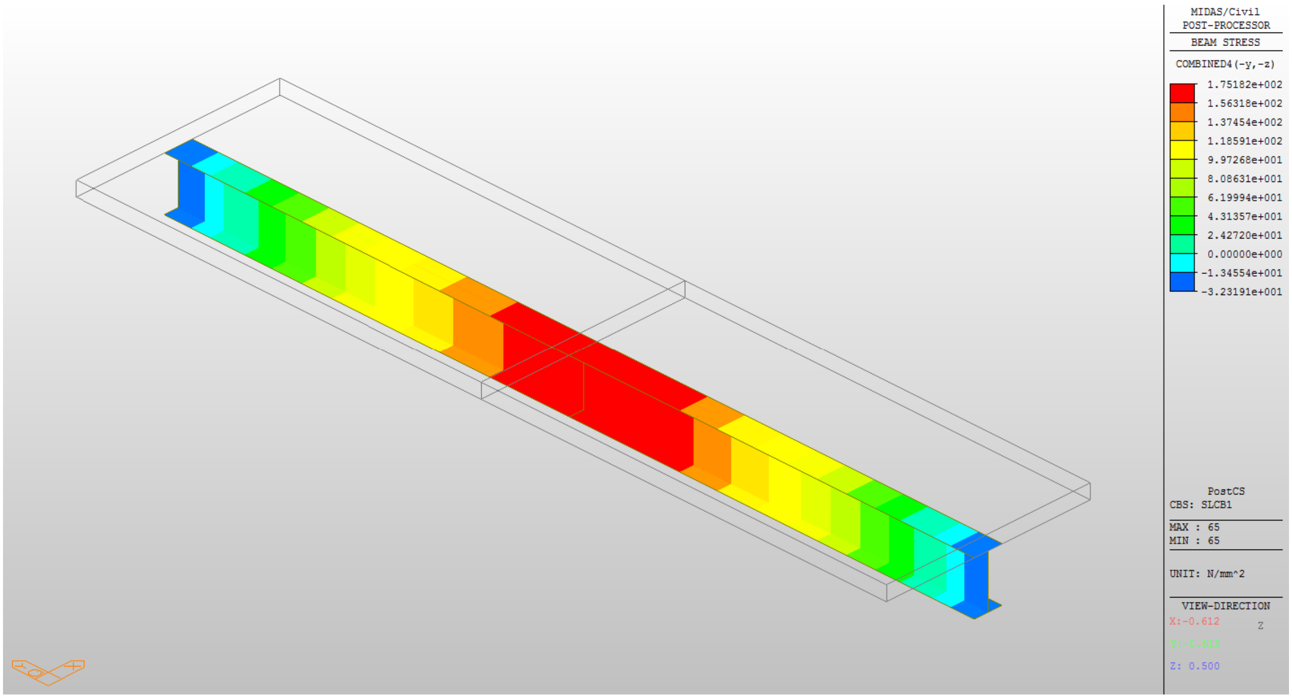


Figura 6.21 : Tensione massima traverso tipo parte acciaio - SLU (N/mm^2)

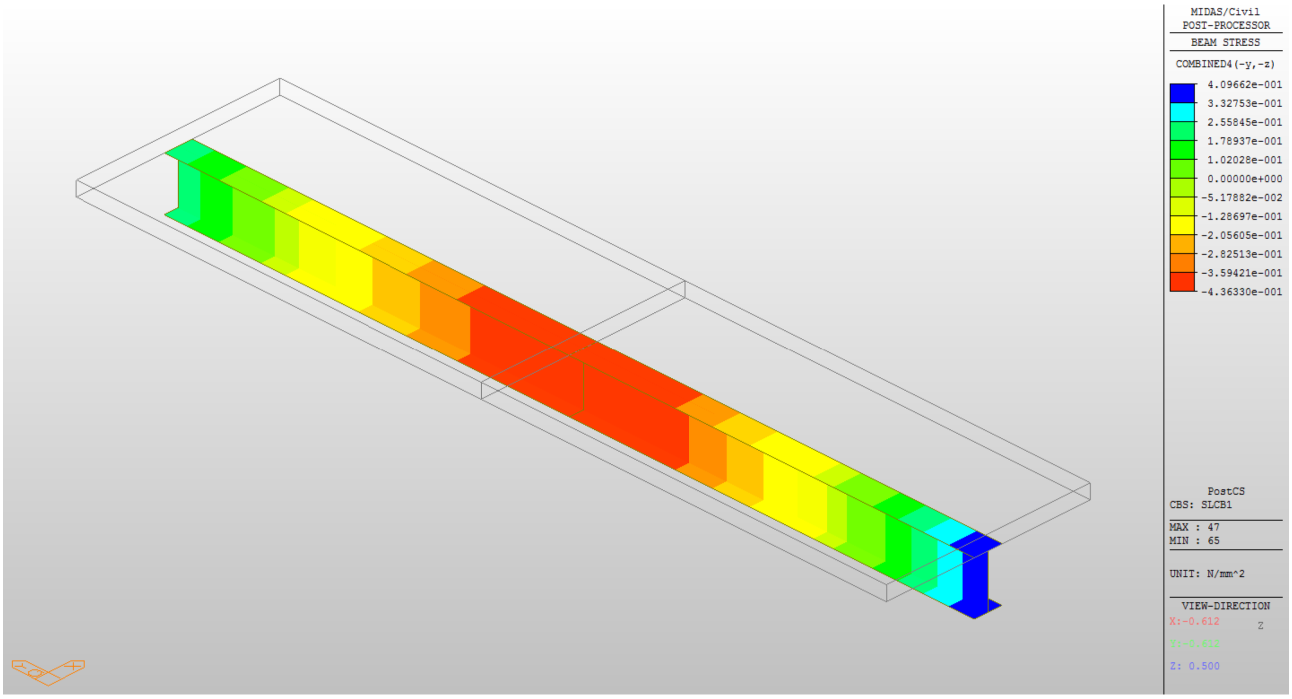


Figura 6.22 : Tensione massima traverso tipo parte calcestruzzo - SLU (N/mm^2)

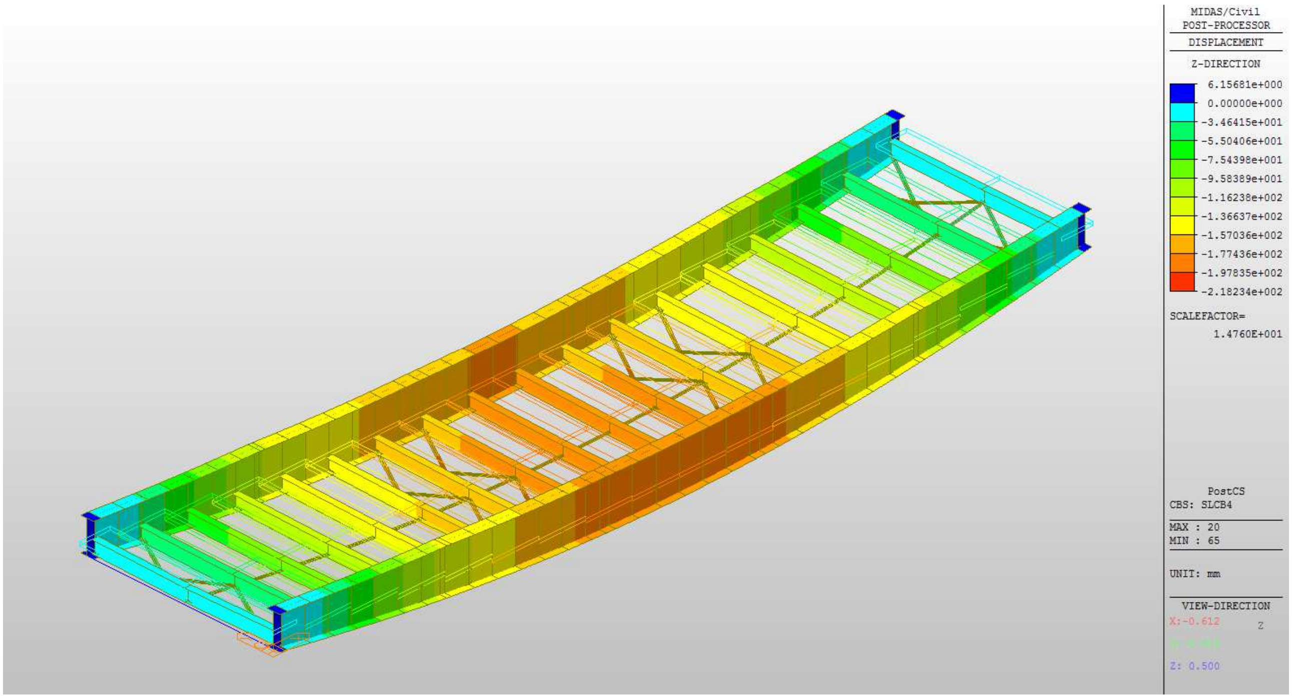


Figura 6.23 : Deformata combinazione SLE rara (mm)

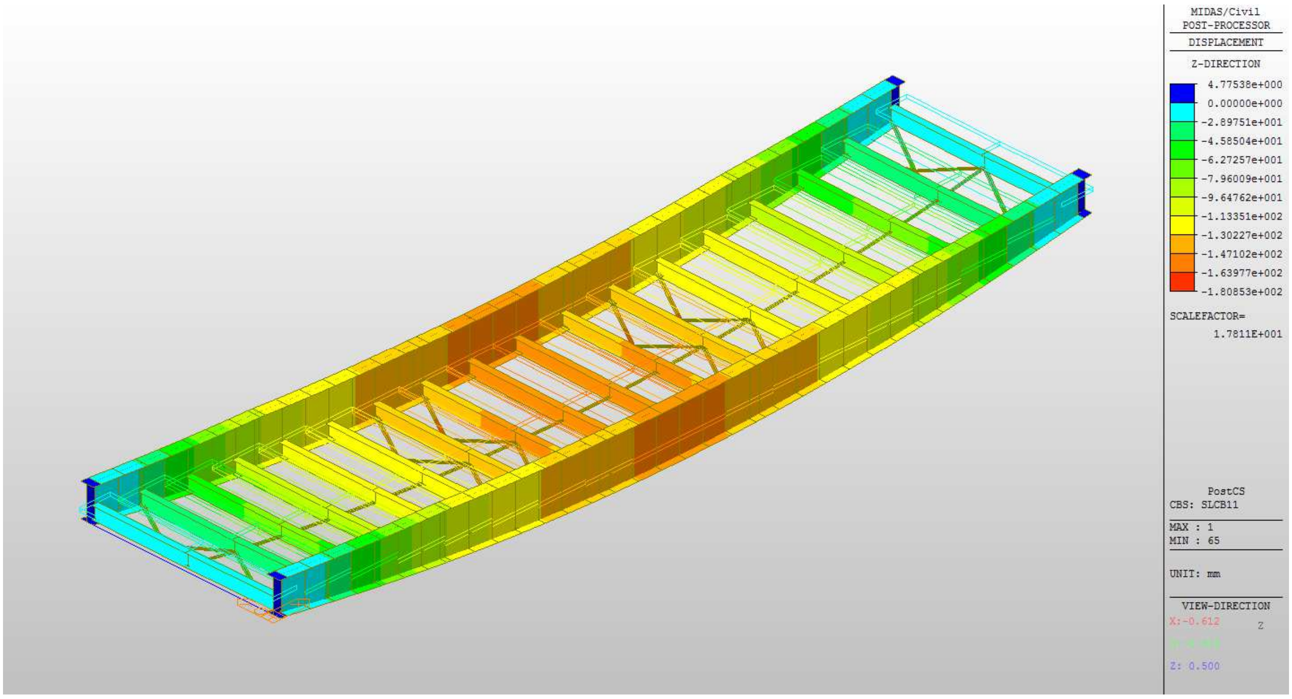


Figura 6.24 : Deformata combinazione SLE quasi permanente (mm)

6.6. VERIFICA DELLE TRAVI PRINCIPALI

Nel seguente capitolo sono riportate le verifiche della sezione delle travi metalliche e delle travi in struttura mista acciaio-calcestruzzo. Nel primo paragrafo sono riportate le verifiche in sintesi di tutte le sezioni delle travi metalliche per poi riportare per le sole sezioni maggiormente sollecitate il dettaglio delle verifiche.
Successivamente si riportano anche le verifiche dei traversi in struttura mista acciaio-calcestruzzo limitatamente alle sezioni più sollecitate relative ai diaframmi di spalla e ai diaframmi intermedi.

6.6.1. Verifiche delle sezioni più sollecitate

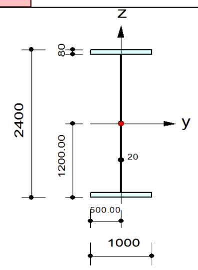
Per ogni concio costituente le travi principali si riportano successivamente le seguenti verifiche:

1. Condizioni di verifica *Design Condition*
2. Momento resistente – SLU *Bending Resistance*
3. Resistenza al taglio verticale – SLU *Resistance to Vertical Shear*
4. Resistenza all'instabilità laterale-torsionale – SLU *Resistance to Lateral Torsional Buckling*
5. Resistenza delle anime alle forze trasversali – SLU *Resistance to Trasverse Force*
6. Resistenza la taglio longitudinale (pioli) – SLU e SLE *Resistance to Longitudinal Shear*
7. Tensioni massime nella sezione mista – SLE Stress Limitation
8. Resistenza la taglio longitudinale (pioli) – SLE *Longitudinal Shear for SLS*

MIDAS/Civil **Steel Checking Result**

Company		Project Title	
or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information



Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 1
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : concio A sx (No:7)
Position I : BH 2400x1000x20/80 (Tapered Section)
Position J : BH 2442.28x1000x20/80
Member Length : 600.000

Depth	2400.00	Web Thick	20.0000
Top F Width	1000.00	Top F Thick	80.0000
Bot.F Width	1000.00	Bot.F Thick	80.0000
Area	204800	Asz	48000.0
Qyb	5267200	Qzb	125000
Iyy	234113706667	Izz	13334826667
Ybar	500.000	Zbar	1200.00
Wely	195094756	Welz	26669653
ry	1069.17	rz	255.169

2. Member Forces

Axial Force Fxx = -22276 (LCB: 7-, POS:I)
Bending Moments My = -46240739, Mz = -643347201
End Moments Myi = -46240739, Myj = -327594666 (for Lb)
Myi = -46240739, Myj = -327594666 (for Ly)
Mzi = -643347201, Mzj = -140023819 (for Lz)
Shear Forces Fyy = -1185200 (LCB: 7-, POS:I)
Fzz = 572282 (LCB: 7+, POS:J)

3. Design Parameters

Unbraced Lengths Ly = 600.000, Lz = 600.000, Lb = 600.000
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/MIN[Nc_Rd, Nb_Rd] = 22276/59379070 = 0.000 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 46240739/64816342718 = 0.001 < 1.000 .... O.K
M_Edz/M_Rdz = 643347201/8934333867 = 0.072 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rc_LT1 = N_Ed/(Xiy*Aeff*fy/Gamma_M1)
Rb_LT1 = kyy*(M_Edy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kyz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rc_LT2 = N_Ed/(Xiz*Aeff*fy/Gamma_M1)
Rb_LT2 = kzy*(M_Edzy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kzz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rmax = MAX[Rcom+Rbend, MAX(Rc_LT1+Rb_LT1, Rc_LT2+Rb_LT2)] = 0.080 < 1.000 .... O.K

Shear Resistance

V_Edy/Vy_Rd = 0.038 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.059 < 1.000 .... O.K

5. Deflection Checking Results

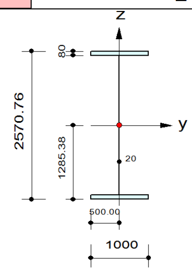
L/ 250.0 = 2.4000 > 0.0002 (Memb:1, LCB: 6, POS: 300.0mm, Dir-Z)...................... O.K

MIDAS/Civil **Steel Checking Result**

Company		Project Title	
or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information

Design Code	: Eurocode3-2:05
Unit System	: N, mm
Member No	: 2
Material	: S355 (No:1)
	(Fy = 335.000, Es = 210000)
Section Name	: concio A sx (No:7)
Position I	: BH 2442.28x1000x20/80 (Tapered Section)
Position J	: BH 2570.76x1000x20/80
Member Length	: 1823.50



Depth	2570.76	Web Thick	20.0000
Top F Width	1000.00	Top F Thick	80.0000
Bot.F Width	1000.00	Bot.F Thick	80.0000
Area	208215	Asz	51415.3
Qyb	5708000	Qzb	125000
Iyy	271592835746	Izz	13334940509
Ybar	500.000	Zbar	1285.38
Wely	211293518	Welz	26669881
ry	1142.10	rz	253.069

2. Member Forces

Axial Force	Fxx = -2271788 (LCB: 7-, POS:J)
Bending Moments	My = 6206474389, Mz = -1225854633
End Moments	Myi = -2654050478, Myj = 6206474389 (for Lb)
	Myi = -2654050478, Myj = 6206474389 (for Ly)
	Mzi = -309779688, Mzj = -1225854633 (for Lz)
Shear Forces	Fyy = 1214739 (LCB: 7+, POS:I)
	Fzz = -5997801 (LCB: 7-, POS:I)

3. Design Parameters

Unbraced Lengths	Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors	Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors	Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/MIN[Nc_Rd, Nb_Rd] = 2271788/59421266 = 0.038 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 6206474389/69721729395 = 0.089 < 1.000 .... O.K

M_Edz/M_Rdz = 1225854633/8934410141 = 0.137 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd

Rc_LT1 = N_Ed/(Xiy*Aeff*fy/Gamma_M1)

Rb_LT1 = kyy*(M_Edy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kyz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)

Rc_LT2 = N_Ed/(Xiz*Aeff*fy/Gamma_M1)

Rb_LT2 = kzy*(M_Edzy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kzz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)

Rmax = MAX[Rcom+Rbend, MAX(Rc_LT1+Rb_LT1, Rc_LT2+Rb_LT2)] = 0.291 < 1.000 .... O.K

Shear Resistance

V_Edy/Vy_Rd = 0.039 < 1.000 .... O.K

V_Edz/Vz_Rd = 0.823 < 1.000 .... O.K

5. Deflection Checking Results

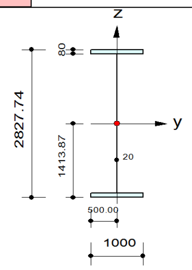
L/ 250.0 = 7.2940 > 0.0201 (Memb:2, LCB: 6, POS:1013.1mm, Dir-Z)...................... O.K

MIDAS/Civil **Steel Checking Result**

	Company		Project Title	
	or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information

Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 3
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : concio A sx (No:7)
Position I : BH 2699.25x1000x20/80 (Tapered Section)
Position J : BH 2827.74x1000x20/80
Member Length : 1823.50



Depth	2827.74	Web Thick	20.0000
Top F Width	1000.00	Top F Thick	80.0000
Bot.F Width	1000.00	Bot.F Thick	80.0000
Area	213355	Asz	56554.7
Qyb	6385076	Qzb	125000
Iyy	333730629086	Izz	13335111825
Ybar	500.000	Zbar	1413.87
Wely	236040803	Welz	26670224
ry	1250.68	rz	250.004

2. Member Forces

Axial Force Fxx = -2163021 (LCB: 7-, POS:J)
Bending Moments My = 19395764216, Mz = -1155631778
End Moments Myi = 13303560118, Myj = 19395764216 (for Lb)
Myi = 13303560118, Myj = 19395764216 (for Ly)
Mzi = -800653640, Mzj = -1155631778 (for Lz)
Shear Forces Fyy = 1154387 (LCB: 7+, POS:I)
Fzz = -5341158 (LCB: 7-, POS:I)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/MIN[Nc_Rd, Nb_Rd] = 2163021/59474583 = 0.036 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 19395764216/77099667333 = 0.252 < 1.000 .... O.K
M_Edz/M_Rdz = 1155631778/8934524922 = 0.129 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rc_LT1 = N_Ed/(Xiy*Aeff*fy/Gamma_M1)
Rb_LT1 = kyy*(M_Edy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kyz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rc_LT2 = N_Ed/(Xiz*Aeff*fy/Gamma_M1)
Rb_LT2 = kzy*(M_Edzy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kzz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rmax = MAX[Rcom+Rbend, MAX(Rc_LT1+Rb_LT1, Rc_LT2+Rb_LT2)] = 0.459 < 1.000 .... O.K

Shear Resistance

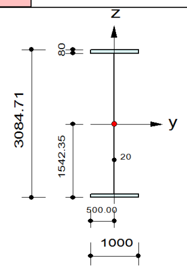
V_Edy/Vy_Rd = 0.037 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.727 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.0950 (Memb:3, LCB: 4, POS: 911.7mm, Dir-Z)...................... O.K

	Company		Project Title	
	or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information



Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 4
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : concio A sx (No:7)
Position I : BH 2956.22x1000x20/80 (Tapered Section)
Position J : BH 3084.71x1000x20/80
Member Length : 1823.50

Depth	3084.71	Web Thick	20.0000
Top F Width	1000.00	Top F Thick	80.0000
Bot.F Width	1000.00	Bot.F Thick	80.0000
Area	218494	Asz	61694.2
Qyb	7078661	Qzb	125000
Iyy	402912888146	Izz	13335283140
Ybar	500.000	Zbar	1542.35
Wely	261232264	Welz	26670566
ry	1357.96	rz	247.048

2. Member Forces

Axial Force Fxx = -1715414 (LCB: 10, POS:J)
Bending Moments My = 43934376267, Mz = -35237208
End Moments Myi = 35949617213, Myj = 43934376267 (for Lb)
Myi = 35949617213, Myj = 43934376267 (for Ly)
Mzi = -157554023, Mzj = -35237208 (for Lz)
Shear Forces Fyy = 1076252 (LCB: 7+, POS:I)
Fzz = -4354625 (LCB: 10, POS:J)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance
N_Ed/MIN[Nc_Rd, Nb_Rd] = 1715414/59518531 = 0.029 < 1.000 .... O.K

Bending Resistance
M_Edy/M_Rdy = 43934376267/84469751106 = 0.520 < 1.000 .... O.K
M_Edz/M_Rdz = 35237208/8934639704 = 0.004 < 1.000 .... O.K

Combined Resistance
Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rc_LT1 = N_Ed/(Xiy*Aeff*fy/Gamma_M1)
Rb_LT1 = kyy*(M_Edy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kyz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rc_LT2 = N_Ed/(Xiz*Aeff*fy/Gamma_M1)
Rb_LT2 = kzy*(M_Edzy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kzz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rmax = MAX[Rcom+Rbend, MAX(Rc_LT1+Rb_LT1, Rc_LT2+Rb_LT2)] = 0.608 < 1.000 .... O.K

Shear Resistance
V_Edy/Vy_Rd = 0.035 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.662 < 1.000 .... O.K

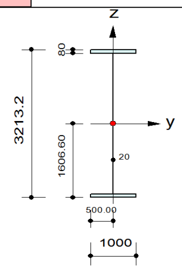
5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1364 (Memb:4, LCB: 4, POS: 911.8mm, Dir-Z)...................... O.K

Company		Project Title	
Author		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information

Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 5
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : concio A sx (No:7)
Position I : BH 3213.2x1000x20/80 (Tapered Section)
Position J : BH 3316x1000x20/80
Member Length : 1459.00



Depth	3213.20	Web Thick	20.0000
Top F Width	1000.00	Top F Thick	80.0000
Bot.F Width	1000.00	Bot.F Thick	80.0000
Area	221064	Asz	64263.9
Qyb	7431644	Qzb	125000
Iyy	440198721350	Izz	13335368798
Ybar	500.000	Zbar	1606.60
Wely	273994264	Welz	26670738
ry	1411.12	rz	245.609

2. Member Forces

Axial Force Fxx = 839708 (LCB: 7+, POS:I)
Bending Moments My = 54407612430, Mz = 889956104
End Moments Myi = 54407612430, Myj = 59805519325 (for Lb)
Myi = 54407612430, Myj = 59805519325 (for Ly)
Mzi = 889956104, Mzj = 218870934 (for Lz)
Shear Forces Fyy = 999421 (LCB: 7+, POS:I)
Fzz = -3759751 (LCB: 10, POS:J)

3. Design Parameters

Unbraced Lengths Ly = 1459.00, Lz = 1459.00, Lb = 1459.00
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance
N_Ed/Nt_Rd = 839708/74056417 = 0.011 < 1.000 .... O.K
Bending Resistance
M_Edy/M_Rdy = 54407612430/88157332511 = 0.617 < 1.000 .... O.K
M_Edz/M_Rdz = 889956104/8934697094 = 0.100 < 1.000 .... O.K
Combined Resistance
Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rmax = MAX[RNRd, (Rcom+Rbend)] = 0.728 < 1.000 .... O.K
Shear Resistance
V_Edy/Vy_Rd = 0.032 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.569 < 1.000 .... O.K

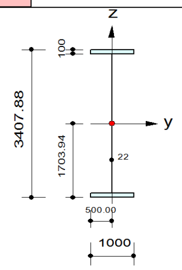
5. Deflection Checking Results

L/ 250.0 = 5.8360 > 0.0995 (Memb:5, LCB: 4, POS: 729.5mm, Dir-Z)...................... O.K

Company		Project Title	
Author		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information

Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 6
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : concio B sx (No:8)
Position I : BH 3366.11x1000x22/100 (Tapered Section)
Position J : BH 3407.88x1000x22/100
Member Length : 1823.50



Depth	3407.88	Web Thick	22.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	270573	Asz	74973.3
Qyb	8804209	Qzb	125000
Iyy	607788296337	Izz	16669513122
Ybar	500.000	Zbar	1703.94
Wely	356696220	Welz	33339026
ry	1498.77	rz	248.210

2. Member Forces

Axial Force Fxx = -1489055 (LCB: 10, POS:J)
Bending Moments My = 71143434725, Mz = 39931308
End Moments Myi = 65321819631, Myj = 71143434725 (for Lb)
Myi = 65321819631, Myj = 71143434725 (for Ly)
Mzi = -148524036, Mzj = 39931308 (for Lz)
Shear Forces Fyy = 939836 (LCB: 7+, POS:I)
Fzz = -3165873 (LCB: 10, POS:J)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance
N_Ed/MIN[Nc_Rd, Nb_Rd] = 1489055/74159821 = 0.020 < 1.000 .... O.K
Bending Resistance
M_Edy/M_Rdy = 71143434725/115514782257 = 0.616 < 1.000 .... O.K
M_Edz/M_Rdz = 39931308/11168573792 = 0.004 < 1.000 .... O.K
Combined Resistance
Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rc_LT1 = N_Ed/(Xiy*Aeff*fy/Gamma_M1)
Rb_LT1 = kyy*(M_Edy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kyz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rc_LT2 = N_Ed/(Xiz*Aeff*fy/Gamma_M1)
Rb_LT2 = kzy*(M_Edzy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kzz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rmax = MAX[Rcom+Rbend, MAX(Rc_LT1+Rb_LT1, Rc_LT2+Rb_LT2)] = 0.703 < 1.000 .... O.K
Shear Resistance
V_Edy/Vy_Rd = 0.024 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.392 < 1.000 .... O.K

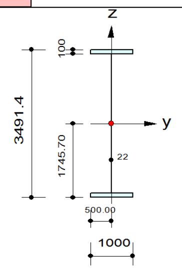
5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1462 (Memb:6, LCB: 4, POS: 911.7mm, Dir-Z)...................... O.K

Company		Project Title	
or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information

Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 7
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : concio B sx (No:8)
Position I : BH 3449.64x1000x22/100 (Tapered Section)
Position J : BH 3491.4x1000x22/100
Member Length : 1823.50



Depth	3491.40	Web Thick	22.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	272411	Asz	76810.9
Qyb	9061905	Qzb	125000
Iyy	640618845251	Izz	16669587239
Ybar	500.000	Zbar	1745.70
Wely	366969151	Welz	33339174
ry	1533.51	rz	247.372

2. Member Forces

Axial Force Fxx = -1546947 (LCB: 10, POS:J)
Bending Moments My = 81216740234, Mz = 5932236
End Moments Myi = 76544750943, Myj = 81216740234 (for Lb)
Myi = 76544750943, Myj = 81216740234 (for Ly)
Mzi = 65639749, Mzj = 5932236 (for Lz)
Shear Forces Fyy = 951411 (LCB: 7+, POS:I)
Fzz = -2535290 (LCB: 10, POS:J)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance
N_Ed/MIN[Nc_Rd, Nb_Rd] = 1546947/74173872 = 0.021 < 1.000 .... O.K

Bending Resistance
M_Edy/M_Rdy = 81216740234/118501012676 = 0.685 < 1.000 .... O.K
M_Edz/M_Rdz = 5932236/11168623450 = 0.001 < 1.000 .... O.K

Combined Resistance
Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rc_LT1 = N_Ed/(Xiy*Aeff*fy/Gamma_M1)
Rb_LT1 = kyy*(M_Edy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kyz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rc_LT2 = N_Ed/(Xiz*Aeff*fy/Gamma_M1)
Rb_LT2 = kzy*(M_Edzy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kzz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rmax = MAX[Rcom+Rbend, MAX(Rc_LT1+Rb_LT1, Rc_LT2+Rb_LT2)] = 0.777 < 1.000 .... O.K

Shear Resistance
V_Edy/Vy_Rd = 0.025 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.335 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1582 (Memb:7, LCB: 4, POS: 911.8mm, Dir-Z)...................... O.K

MIDAS/Civil **Steel Checking Result**

Company		Project Title	
or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information

Design Code : Eurocode3-2:05

Unit System : N, mm

Member No : 8

Material : S355 (No:1)

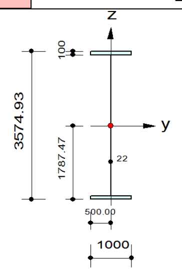
(Fy = 335.000, Es = 210000)

Section Name : concio B sx (No:8)

Position I : BH 3533.17x1000x22/100 (Tapered Section)

Position J : BH 3574.93x1000x22/100

Member Length : 1823.50



Depth	3574.93	Web Thick	22.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	274249	Asz	78648.5
Qyb	9321345	Qzb	125000
Iyy	674399691071	Izz	16669661357
Ybar	500.000	Zbar	1787.47
Wely	377293673	Welz	33339323
ry	1568.15	rz	246.542

2. Member Forces

Axial Force Fxx = -1510469 (LCB: 10, POS:J)

Bending Moments My = 89187380768, Mz = -516971536

End Moments Myi = 85638248581, Myj = 89187380768 (for Lb)

Myi = 85638248581, Myj = 89187380768 (for Ly)

Mzi = 507684318, Mzj = -516971536 (for Lz)

Shear Forces Fyy = 1007107 (LCB: 7+, POS:I)

Fzz = -1972989 (LCB: 10, POS:I)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50

Effective Length Factors Ky = 1.00, Kz = 1.00

Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/MIN[Nc_Rd, Nb_Rd] = 1510469/74187227 = 0.020 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 89187380768/121486646395 = 0.734 < 1.000 .... O.K

M_Edz/M_Rdz = 516971536/11168673109 = 0.046 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd

Rc_LT1 = N_Ed/(Xiy*Aeff*fy/Gamma_M1)

Rb_LT1 = kyy*(M_Edy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kyz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)

Rc_LT2 = N_Ed/(Xiz*Aeff*fy/Gamma_M1)

Rb_LT2 = kzy*(M_Edzy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kzz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)

Rmax = MAX[Rcom+Rbend, MAX(Rc_LT1+Rb_LT1, Rc_LT2+Rb_LT2)] = 0.881 < 1.000 .... O.K

Shear Resistance

V_Edy/Vy_Rd = 0.026 < 1.000 .... O.K

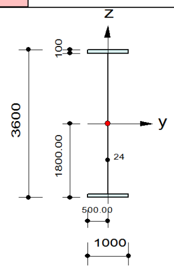
V_Edz/Vz_Rd = 0.269 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1641 (Memb:8, LCB: 4, POS: 911.8mm, Dir-Z)...................... O.K

1. Design Information

Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 9
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : concio C (No:6)
(Rolled : concio C).
Member Length : 1823.50



2. Member Forces

Axial Force Fxx = -1250273 (LCB: 10, POS:I)
Bending Moments My = 92212714599, Mz = -721131768
End Moments Myi = 92212714599, Myj = 92699172056 (for Lb)
Myi = 92212714599, Myj = 92699172056 (for Ly)
Mzi = -721131768, Mzj = 292329984 (for Lz)
Shear Forces Fyy = 1004877 (LCB: 7+, POS:I)
Fzz = -1531280 (LCB: 7-, POS:I)

Depth	3600.00	Web Thick	24.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	281600	Asz	86400.0
Qyb	8736667	Qzb	125000
Iyy	691274666667	Izz	16670583467
Ybar	500.000	Zbar	1800.00
Wely	384041481	Welz	33341167
ry	1566.78	rz	243.310

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/MIN[Nc_Rd, Nb_Rd] = 1250273/75501496 = 0.017 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 92212714599/124151897436 = 0.743 < 1.000 .... O.K

M_Edz/M_Rdz = 721131768/11169290923 = 0.065 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd

Rc_LT1 = N_Ed/(Xiy*Aeff*fy/Gamma_M1)

Rb_LT1 = kyy*(M_Edy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kyz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)

Rc_LT2 = N_Ed/(Xiz*Aeff*fy/Gamma_M1)

Rb_LT2 = kzy*(M_Edzy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kzz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)

Rmax = MAX[Rcom+Rbend, MAX(Rc_LT1+Rb_LT1, Rc_LT2+Rb_LT2)] = 0.906 < 1.000 .... O.K

Shear Resistance

V_Edy/Vy_Rd = 0.026 < 1.000 .... O.K

V_Edz/Vz_Rd = 0.153 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1669 (Memb:9, LCB: 4, POS: 911.8mm, Dir-Z)...................... O.K

MIDAS/Civil — Steel Checking Result

Company		Project Title	
or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information

Design Code : Eurocode3-2:05

Unit System : N, mm

Member No : 10

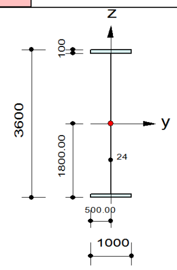
Material : S355 (No:1)

(Fy = 335.000, Es = 210000)

Section Name : concio C (No:6)

(Rolled : concio C).

Member Length : 1824.00



2. Member Forces

Axial Force Fxx = -1149317 (LCB: 9, POS:J)

Bending Moments My = 95324915892, Mz = -554606315

End Moments Myi = 94284487911, Myj = 95324915892 (for Lb)

Myi = 94284487911, Myj = 95324915892 (for Ly)

Mzi = 227458551, Mzj = -554606315 (for Lz)

Shear Forces Fyy = 946666 (LCB: 7+, POS:I)

Fzz = 767412 (LCB: 7+, POS:J)

Depth	3600.00	Web Thick	24.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	281600	Asz	86400.0
Qyb	8736667	Qzb	125000
Iyy	691274666667	Izz	16670583467
Ybar	500.000	Zbar	1800.00
Wely	384041481	Welz	33341167
ry	1566.78	rz	243.310

3. Design Parameters

Unbraced Lengths Ly = 1824.00, Lz = 1824.00, Lb = 1824.00

Effective Length Factors Ky = 1.00, Kz = 1.00

Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/MIN[Nc_Rd, Nb_Rd] = 1149317/75501496 = 0.015 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 95324915892/124151897436 = 0.768 < 1.000 .... O.K

M_Edz/M_Rdz = 554606315/11169290923 = 0.050 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd

Rc_LT1 = N_Ed/(Xiy*Aeff*fy/Gamma_M1)

Rb_LT1 = kyy*(M_Edy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kyz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)

Rc_LT2 = N_Ed/(Xiz*Aeff*fy/Gamma_M1)

Rb_LT2 = kzy*(M_Edzy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kzz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)

Rmax = MAX[Rcom+Rbend, MAX(Rc_LT1+Rb_LT1, Rc_LT2+Rb_LT2)] = 0.916 < 1.000 .... O.K

Shear Resistance

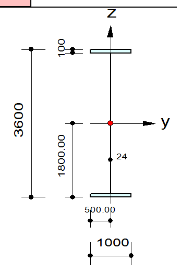
V_Edy/Vy_Rd = 0.024 < 1.000 .... O.K

V_Edz/Vz_Rd = 0.097 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 7.2960 > 0.1708 (Memb:10, LCB: 4, POS: 912.0mm, Dir-Z)..................... O.K

1. Design Information



Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 11
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : concio C (No:6)
(Rolled : concio C).
Member Length : 1823.50

2. Member Forces

Axial Force Fxx = -1055209 (LCB: 9, POS:I)
Bending Moments My = 94911385399, Mz = -503658390
End Moments Myi = 94911385399, Myj = 92913028330 (for Lb)
Myi = 94911385399, Myj = 92913028330 (for Ly)
Mzi = -503658390, Mzj = 426872541 (for Lz)
Shear Forces Fyy = 880616 (LCB: 7+, POS:I)
Fzz = 1385031 (LCB: 7+, POS:J)

Depth	3600.00	Web Thick	24.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	281600	Asz	86400.0
Qyb	8736667	Qzb	125000
Iyy	691274666667	Izz	16670583467
Ybar	500.000	Zbar	1800.00
Wely	384041481	Welz	33341167
ry	1566.78	rz	243.310

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/MIN[Nc_Rd, Nb_Rd] = 1055209/75501496 = 0.014 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 94911385399/124151897436 = 0.764 < 1.000 .... O.K
M_Edz/M_Rdz = 503658390/11169290923 = 0.045 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rc_LT1 = N_Ed/(Xiy*Aeff*fy/Gamma_M1)
Rb_LT1 = kyy*(M_Edy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kyz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rc_LT2 = N_Ed/(Xiz*Aeff*fy/Gamma_M1)
Rb_LT2 = kzy*(M_Edzy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kzz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rmax = MAX[Rcom+Rbend, MAX(Rc_LT1+Rb_LT1, Rc_LT2+Rb_LT2)] = 0.906 < 1.000 .... O.K

Shear Resistance

V_Edy/Vy_Rd = 0.023 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.174 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1697 (Memb:11, LCB: 4, POS: 911.8mm, Dir-Z)..................... O.K

1. Design Information

Design Code : Eurocode3-2:05

Unit System : N, mm

Member No : 12

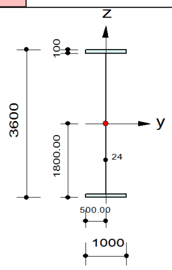
Material : S355 (No:1)

(Fy = 335.000, Es = 210000)

Section Name : concio C (No:6)

(Rolled : concio C).

Member Length : 729.000



2. Member Forces

Axial Force Fxx = -1059761 (LCB: 9, POS:I)

Bending Moments My = 90653413842, Mz = -77778083

End Moments Myi = 90653413842, Myj = 89418277339 (for Lb)

Myi = 90653413842, Myj = 89418277339 (for Ly)

Mzi = -77778083, Mzj = 83908841 (for Lz)

Shear Forces Fyy = 864704 (LCB: 7+, POS:I)

Fzz = 1953208 (LCB: 7+, POS:I)

Depth	3600.00	Web Thick	24.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	281600	Asz	86400.0
Qyb	8736667	Qzb	125000
Iyy	691274666667	Izz	16670583467
Ybar	500.000	Zbar	1800.00
Wely	384041481	Welz	33341167
ry	1566.78	rz	243.310

3. Design Parameters

Unbraced Lengths Ly = 729.000, Lz = 729.000, Lb = 729.000

Effective Length Factors Ky = 1.00, Kz = 1.00

Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/MIN[Nc_Rd, Nb_Rd] = 1059761/75501496 = 0.014 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 90653413842/124151897436 = 0.730 < 1.000 .... O.K

M_Edz/M_Rdz = 77778083/11169290923 = 0.007 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd

Rc_LT1 = N_Ed/(Xiy*Aeff*fy/Gamma_M1)

Rb_LT1 = kyy*(M_Edy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kyz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)

Rc_LT2 = N_Ed/(Xiz*Aeff*fy/Gamma_M1)

Rb_LT2 = kzy*(M_Edzy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kzz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)

Rmax = MAX[Rcom+Rbend, MAX(Rc_LT1+Rb_LT1, Rc_LT2+Rb_LT2)] = 0.826 < 1.000 .... O.K

Shear Resistance

V_Edy/Vy_Rd = 0.022 < 1.000 .... O.K

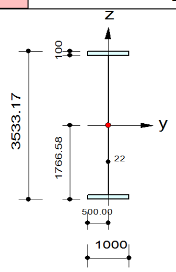
V_Edz/Vz_Rd = 0.175 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 2.9160 > 0.0264 (Memb:12, LCB: 4, POS: 364.5mm, Dir-Z)..................... O.K

Company		Project Title	
Author		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information



Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 13
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : Concio B dx (No:10)
Position I : BH 3533.17x1000x22/100 (Tapered Section)
Position J : BH 3491.4x1000x22/100
Member Length : 1823.50

Depth	3533.17	Web Thick	22.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	273330	Asz	77729.7
Qyb	9191407	Qzb	125000
Iyy	657390080394	Izz	16669624298
Ybar	500.000	Zbar	1766.58
Wely	372124965	Welz	33339249
ry	1550.84	rz	246.956

2. Member Forces

Axial Force Fxx = 109427 (LCB: 7+, POS:I)
Bending Moments My = 87444826297, Mz = 834284341
End Moments Myi = 87444826297, Myj = 83635954564 (for Lb)
Myi = 87444826297, Myj = 83635954564 (for Ly)
Mzi = 834284341, Mzj = 514737450 (for Lz)
Shear Forces Fyy = 949943 (LCB: 7+, POS:I)
Fzz = 2577822 (LCB: 7+, POS:I)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

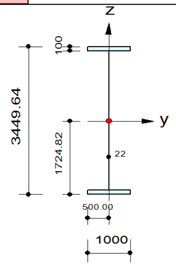
Axial Resistance
N_Ed/Nt_Rd = 109427/91565451 = 0.001 < 1.000 .... O.K
Bending Resistance
M_Edy/M_Rdy = 87444826297/119993904124 = 0.729 < 1.000 .... O.K
M_Edz/M_Rdz = 834284341/11168648280 = 0.075 < 1.000 .... O.K
Combined Resistance
Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rmax = MAX[RNRd, (Rcom+Rbend)] = 0.805 < 1.000 .... O.K
Shear Resistance
V_Edy/Vy_Rd = 0.025 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.351 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1632 (Memb:13, LCB: 4, POS: 911.8mm, Dir-Z)..................... O.K

Company		Project Title	
or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information



Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 14
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : Concio B dx (No:10)
Position I : BH 3449.64x1000x22/100 (Tapered Section)
Position J : BH 3407.88x1000x22/100
Member Length : 1823.50

Depth	3449.64	Web Thick	22.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	271492	Asz	75892.1
Qyb	8932839	Qzb	125000
Iyy	624085184335	Izz	16669550181
Ybar	500.000	Zbar	1724.82
Wely	361826235	Welz	33339100
ry	1516.15	rz	247.790

2. Member Forces

Axial Force Fxx = 143174 (LCB: 7+, POS:I)
Bending Moments My = 79813103959, Mz = 870203815
End Moments Myi = 79813103959, Myj = 74605801348 (for Lb)
Myi = 79813103959, Myj = 74605801348 (for Ly)
Mzi = 870203815, Mzj = 521836817 (for Lz)
Shear Forces Fyy = 1015271 (LCB: 7+, POS:I)
Fzz = 3231066 (LCB: 7+, POS:I)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/Nt_Rd = 143174/90949849 = 0.002 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 79813103959/117007972024 = 0.682 < 1.000 .... O.K
M_Edz/M_Rdz = 870203815/11168598621 = 0.078 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rmax = MAX[RNRd, (Rcom+Rbend)] = 0.762 < 1.000 .... O.K

Shear Resistance

V_Edy/Vy_Rd = 0.026 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.420 < 1.000 .... O.K

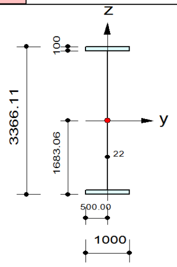
5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1550 (Memb:14, LCB: 4, POS: 911.8mm, Dir-Z)...................... O.K

MIDAS/Civil **Steel Checking Result**

Company		**Project Title**	
or		**File Name**	C:\...\cavalcavia_rev4.mcb

1. Design Information



Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 15
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : Concio B dx (No:10)
Position I : BH 3366.11x1000x22/100 (Tapered Section)
Position J : BH 3324.35x1000x22/100
Member Length : 1823.50

Depth	3366.11	Web Thick	22.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	269654	Asz	74054.5
Qyb	8676016	Qzb	125000
Iyy	591727379947	Izz	16669476064
Ybar	500.000	Zbar	1683.06
Wely	351579112	Welz	33338952
ry	1481.35	rz	248.632

2. Member Forces

Axial Force Fxx = 81367.8 (LCB: 7+, POS:I)
Bending Moments My = 69164979912, Mz = 820887851
End Moments Myi = 69164979912, Myj = 62603135564 (for Lb)
Myi = 69164979912, Myj = 62603135564 (for Ly)
Mzi = 820887851, Mzj = 558687306 (for Lz)
Shear Forces Fyy = 991873 (LCB: 7+, POS:I)
Fzz = 3879806 (LCB: 7+, POS:I)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance
N_Ed/Nt_Rd = 81368/90334247 = 0.001 < 1.000 .... O.K
Bending Resistance
M_Edy/M_Rdy = 69164979912/114021443583 = 0.607 < 1.000 .... O.K
M_Edz/M_Rdz = 820887851/11168548963 = 0.073 < 1.000 .... O.K
Combined Resistance
Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rmax = MAX[RNRd, (Rcom+Rbend)] = 0.681 < 1.000 .... O.K
Shear Resistance
V_Edy/Vy_Rd = 0.026 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.472 < 1.000 .... O.K

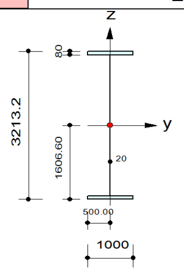
5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1396 (Memb:15, LCB: 4, POS: 911.7mm, Dir-Z)..................... O.K

MIDAS/Civil **Steel Checking Result**

Company		Project Title	
or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information



Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 16
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : Concio A dx (No:9)
Position I : BH 3213.2x1000x20/80 (Tapered Section)
Position J : BH 3084.71x1000x20/80
Member Length : 1823.50

Depth	3213.20	Web Thick	20.0000
Top F Width	1000.00	Top F Thick	80.0000
Bot.F Width	1000.00	Bot.F Thick	80.0000
Area	221064	Asz	64263.9
Qyb	7431644	Qzb	125000
Iyy	440198721350	Izz	13335368798
Ybar	500.000	Zbar	1606.60
Wely	273994264	Welz	26670738
ry	1411.12	rz	245.609

2. Member Forces

Axial Force Fxx = -56557 (LCB: 7+, POS:I)
Bending Moments My = 55833075473, Mz = 843482827
End Moments Myi = 55833075473, Myj = 47975078211 (for Lb)
Myi = 55833075473, Myj = 47975078211 (for Ly)
Mzi = 843482827, Mzj = 634815532 (for Lz)
Shear Forces Fyy = 970168 (LCB: 7+, POS:I)
Fzz = 4516991 (LCB: 7+, POS:I)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance
N_Ed/MIN[Nc_Rd, Nb_Rd] = 56557/59537731 = 0.001 < 1.000 .... O.K
Bending Resistance
M_Edy/M_Rdy = 55833075473/88157332511 = 0.633 < 1.000 .... O.K
M_Edz/M_Rdz = 843482827/8934697094 = 0.094 < 1.000 .... O.K
Combined Resistance
Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rc_LT1 = N_Ed/(Xiy*Aeff*fy/Gamma_M1)
Rb_LT1 = kyy*(M_Edy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kyz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rc_LT2 = N_Ed/(Xiz*Aeff*fy/Gamma_M1)
Rb_LT2 = kzy*(M_Edzy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kzz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rmax = MAX[Rcom+Rbend, MAX(Rc_LT1+Rb_LT1, Rc_LT2+Rb_LT2)] = 0.802 < 1.000 .... O.K
Shear Resistance
V_Edy/Vy_Rd = 0.031 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.731 < 1.000 .... O.K

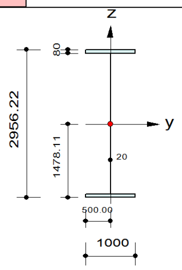
5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1519 (Memb:16, LCB: 4, POS: 911.8mm, Dir-Z)..................... O.K

Company		Project Title	
or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information

Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 17
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : Concio A dx (No:9)
Position I : BH 2956.22x1000x20/80 (Tapered Section)
Position J : BH 2827.74x1000x20/80
Member Length : 1823.50



Depth	2956.22	Web Thick	20.0000
Top F Width	1000.00	Top F Thick	80.0000
Bot.F Width	1000.00	Bot.F Thick	80.0000
Area	215924	Asz	59124.5
Qyb	6729805	Qzb	125000
Iyy	367430594595	Izz	13335197482
Ybar	500.000	Zbar	1478.11
Wely	248581076	Welz	26670395
ry	1304.48	rz	248.513

2. Member Forces

Axial Force Fxx = -116120 (LCB: 7+, POS:I)
Bending Moments My = 39852476356, Mz = 801106043
End Moments Myi = 39852476356, Myj = 30664997507 (for Lb)
Myi = 39852476356, Myj = 30664997507 (for Ly)
Mzi = 801106043, Mzj = 653825483 (for Lz)
Shear Forces Fyy = 971096 (LCB: 7+, POS:I)
Fzz = 5165499 (LCB: 7+, POS:I)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/MIN[Nc_Rd, Nb_Rd] = 116120/59497567 = 0.002 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 39852476356/80786800463 = 0.493 < 1.000 .... O.K
M_Edz/M_Rdz = 801106043/8934582313 = 0.090 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rc_LT1 = N_Ed/(Xiy*Aeff*fy/Gamma_M1)
Rb_LT1 = kyy*(M_Edy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kyz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rc_LT2 = N_Ed/(Xiz*Aeff*fy/Gamma_M1)
Rb_LT2 = kzy*(M_Edzy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kzz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rmax = MAX[Rcom+Rbend, MAX(Rc_LT1+Rb_LT1, Rc_LT2+Rb_LT2)] = 0.643 < 1.000 .... O.K

Shear Resistance

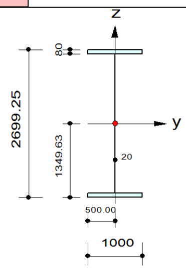
V_Edy/Vy_Rd = 0.031 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.771 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1239 (Memb:17, LCB: 4, POS: 911.8mm, Dir-Z)..................... O.K

Company		Project Title	
or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information



Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 18
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : Concio A dx (No:9)
Position I : BH 2699.25x1000x20/80 (Tapered Section)
Position J : BH 2570.76x1000x20/80
Member Length : 1823.50

Depth	2699.25	Web Thick	20.0000
Top F Width	1000.00	Top F Thick	80.0000
Bot.F Width	1000.00	Bot.F Thick	80.0000
Area	210785	Asz	53985.0
Qyb	6044474	Qzb	125000
Iyy	301791780006	Izz	13335026167
Ybar	500.000	Zbar	1349.63
Wely	223611568	Welz	26670052
ry	1196.56	rz	251.523

2. Member Forces

Axial Force Fxx = -174719 (LCB: 7+, POS:I)
Bending Moments My = 21162663350, Mz = 736290270
End Moments Myi = 21162663350, Myj = 10661910867 (for Lb)
Myi = 21162663350, Myj = 10661910867 (for Ly)
Mzi = 736290270, Mzj = 575997369 (for Lz)
Shear Forces Fyy = 915520 (LCB: 7+, POS:I)
Fzz = 5810209 (LCB: 7+, POS:I)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

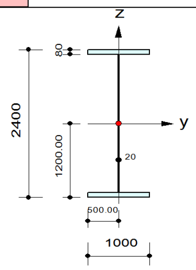
Axial Resistance
N_Ed/MIN[Nc_Rd, Nb_Rd] = 174719/59449273 = 0.003 < 1.000 .... O.K
Bending Resistance
M_Edy/M_Rdy = 21162663350/73411302212 = 0.288 < 1.000 .... O.K
M_Edz/M_Rdz = 736290270/8934467532 = 0.082 < 1.000 .... O.K
Combined Resistance
Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rc_LT1 = N_Ed/(Xiy*Aeff*fy/Gamma_M1)
Rb_LT1 = kyy*(M_Edy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kyz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rc_LT2 = N_Ed/(Xiz*Aeff*fy/Gamma_M1)
Rb_LT2 = kzy*(M_Edzy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kzz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rmax = MAX[Rcom+Rbend, MAX(Rc_LT1+Rb_LT1, Rc_LT2+Rb_LT2)] = 0.411 < 1.000 .... O.K
Shear Resistance
V_Edy/Vy_Rd = 0.030 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.810 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.0683 (Memb:18, LCB: 4, POS: 911.8mm, Dir-Z)..................... O.K

Company		Project Title	
or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information



Design Code : Eurocode3-2:05

Unit System : N, mm

Member No : 19

Material : S355 (No:1)

(Fy = 335.000, Es = 210000)

Section Name : Concio A dx (No:9)

Position I : BH 2442.28x1000x20/80 (Tapered Section)

Position J : BH 2400x1000x20/80

Member Length : 600.000

Depth	2400.00	Web Thick	20.0000
Top F Width	1000.00	Top F Thick	80.0000
Bot.F Width	1000.00	Bot.F Thick	80.0000
Area	204800	Asz	48000.0
Qyb	5267200	Qzb	125000
Iyy	234113706667	Izz	13334826667
Ybar	500.000	Zbar	1200.00
Wely	195094756	Welz	26669653
ry	1069.17	rz	255.169

2. Member Forces

Axial Force Fxx = -44971 (LCB: 7-, POS:J)

Bending Moments My = -94339466, Mz = -665190703

End Moments Myi = -362809757, Myj = -94339466 (for Lb)

Myi = -362809757, Myj = -94339466 (for Ly)

Mzi = -218418281, Mzj = -665190703 (for Lz)

Shear Forces Fyy = 1185603 (LCB: 7+, POS:I)

Fzz = -572063 (LCB: 7-, POS:I)

3. Design Parameters

Unbraced Lengths Ly = 600.000, Lz = 600.000, Lb = 600.000

Effective Length Factors Ky = 1.00, Kz = 1.00

Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/MIN[Nc_Rd, Nb_Rd] = 44971/59379070 = 0.001 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 94339466/64816342718 = 0.001 < 1.000 .... O.K

M_Edz/M_Rdz = 665190703/8934333867 = 0.074 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd

Rc_LT1 = N_Ed/(Xiy*Aeff*fy/Gamma_M1)

Rb_LT1 = kyy*(M_Edy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kyz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)

Rc_LT2 = N_Ed/(Xiz*Aeff*fy/Gamma_M1)

Rb_LT2 = kzy*(M_Edzy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kzz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)

Rmax = MAX[Rcom+Rbend, MAX(Rc_LT1+Rb_LT1, Rc_LT2+Rb_LT2)] = 0.084 < 1.000 .... O.K

Shear Resistance

V_Edy/Vy_Rd = 0.038 < 1.000 .... O.K

V_Edz/Vz_Rd = 0.059 < 1.000 .... O.K

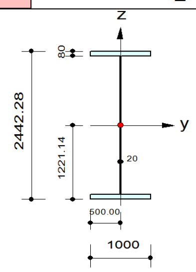
5. Deflection Checking Results

L/ 250.0 = 2.4000 > 0.0002 (Memb:19, LCB: 5, POS: 300.0mm, Dir-Z)..................... O.K

Company		Project Title	
or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information

Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 20
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : concio A sx (No:7)
Position I : BH 2400x1000x20/80 (Tapered Section)
Position J : BH 2442.28x1000x20/80
Member Length : 600.000



Depth	2442.28	Web Thick	20.0000
Top F Width	1000.00	Top F Thick	80.0000
Bot.F Width	1000.00	Bot.F Thick	80.0000
Area	205646	Asz	48845.5
Qyb	5375652	Qzb	125000
Iyy	243112584692	Izz	13334854851
Ybar	500.000	Zbar	1221.14
Wely	199086830	Welz	26669710
ry	1087.29	rz	254.645

2. Member Forces

Axial Force Fxx = -26929 (LCB: 7-, POS:J)
Bending Moments My = -288157506, Mz = -563673882
End Moments Myi = -45345270, Myj = -288157506 (for Lb)
Myi = -45345270, Myj = -288157506 (for Ly)
Mzi = -491569630, Mzj = -563673882 (for Lz)
Shear Forces Fyy = 1185200 (LCB: 7+, POS:I)
Fzz = 479167 (LCB: 7+, POS:J)

3. Design Parameters

Unbraced Lengths Ly = 600.000, Lz = 600.000, Lb = 600.000
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/MIN[Nc_Rd, Nb_Rd] = 26929/59390105 = 0.000 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 288157506/66030984895 = 0.004 < 1.000 .... O.K
M_Edz/M_Rdz = 563673882/8934352750 = 0.063 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rc_LT1 = N_Ed/(Xiy*Aeff*fy/Gamma_M1)
Rb_LT1 = kyy*(M_Edy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kyz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rc_LT2 = N_Ed/(Xiz*Aeff*fy/Gamma_M1)
Rb_LT2 = kzy*(M_Edzy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kzz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rmax = MAX[Rcom+Rbend, MAX(Rc_LT1+Rb_LT1, Rc_LT2+Rb_LT2)] = 0.075 < 1.000 .... O.K

Shear Resistance

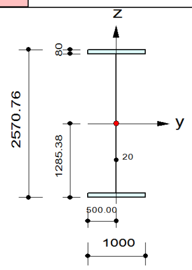
V_Edy/Vy_Rd = 0.038 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.050 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 2.4000 > 0.0002 (Memb:20, LCB: 5, POS: 300.0mm, Dir-Z)..................... O.K

Company		**Project Title**	
or		**File Name**	C:\...\cavalcavia_rev4.mcb

1. Design Information



Design Code : Eurocode3-2:05

Unit System : N, mm

Member No : 21

Material : S355 (No:1)

(Fy = 335.000, Es = 210000)

Section Name : concio A sx (No:7)

Position I : BH 2442.28x1000x20/80 (Tapered Section)

Position J : BH 2570.76x1000x20/80

Member Length : 1823.50

Depth	2570.76	Web Thick	20.0000
Top F Width	1000.00	Top F Thick	80.0000
Bot.F Width	1000.00	Bot.F Thick	80.0000
Area	208215	Asz	51415.3
Qyb	5708000	Qzb	125000
Iyy	271592835746	Izz	13334940509
Ybar	500.000	Zbar	1285.38
Wely	211293518	Welz	26669881
ry	1142.10	rz	253.069

2. Member Forces

Axial Force Fxx = 1697198 (LCB: 7+, POS:J)

Bending Moments My = 10942183806, Mz = 1318540049

End Moments Myi = 2339195963, Myj = 10942183806 (for Lb)

Myi = 2339195963, Myj = 10942183806 (for Ly)

Mzi = 290646534, Mzj = 1318540049 (for Lz)

Shear Forces Fyy = -1247203 (LCB: 7-, POS:I)

Fzz = -5762820 (LCB: 7-, POS:I)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50

Effective Length Factors Ky = 1.00, Kz = 1.00

Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/Nt_Rd = 1697198/69752116 = 0.024 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 10942183806/69721729395 = 0.157 < 1.000 .... O.K

M_Edz/M_Rdz = 1318540049/8934410141 = 0.148 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd

Rmax = MAX[RNRd, (Rcom+Rbend)] = 0.192 < 1.000 .... O.K

Shear Resistance

V_Edy/Vy_Rd = 0.040 < 1.000 .... O.K

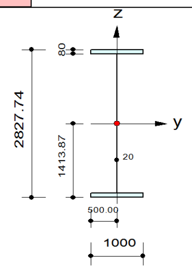
V_Edz/Vz_Rd = 0.790 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.0305 (Memb:21, LCB: 4, POS:1013.1mm, Dir-Z)...................... O.K

Company		**Project Title**	
or		**File Name**	C:\...\cavalcavia_rev4.mcb

1. Design Information



Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 22
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : concio A sx (No:7)
Position I : BH 2699.25x1000x20/80 (Tapered Section)
Position J : BH 2827.74x1000x20/80
Member Length : 1823.50

Depth	2827.74	Web Thick	20.0000
Top F Width	1000.00	Top F Thick	80.0000
Bot.F Width	1000.00	Bot.F Thick	80.0000
Area	213355	Asz	56554.7
Qyb	6385076	Qzb	125000
Iyy	333730629086	Izz	13335111825
Ybar	500.000	Zbar	1413.87
Wely	236040803	Welz	26670224
ry	1250.68	rz	250.004

2. Member Forces

Axial Force Fxx = 1557512 (LCB: 7+, POS:J)
Bending Moments My = 28755979612, Mz = 1231073353
End Moments Myi = 19892627338, Myj = 28755979612 (for Lb)
Myi = 19892627338, Myj = 28755979612 (for Ly)
Mzi = 781265740, Mzj = 1231073353 (for Lz)
Shear Forces Fyy = -1150955 (LCB: 7-, POS:I)
Fzz = -5126526 (LCB: 7-, POS:I)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/Nt_Rd = 1557512/71473836 = 0.022 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 28755979612/77099667333 = 0.373 < 1.000 .... O.K
M_Edz/M_Rdz = 1231073353/8934524922 = 0.138 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rmax = MAX[RNRd, (Rcom+Rbend)] = 0.357 < 1.000 .... O.K

Shear Resistance

V_Edy/Vy_Rd = 0.037 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.698 < 1.000 .... O.K

5. Deflection Checking Results

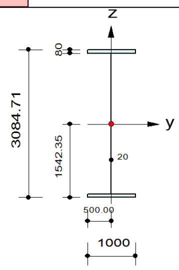
L/ 250.0 = 7.2940 > 0.0977 (Memb:22, LCB: 4, POS: 911.7mm, Dir-Z)...................... O.K

Steel Checking Result

Company		Project Title	
or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information

Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 23
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : concio A sx (No:7)
Position I : BH 2956.22x1000x20/80 (Tapered Section)
Position J : BH 3084.71x1000x20/80
Member Length : 1823.50



Depth	3084.71	Web Thick	20.0000
Top F Width	1000.00	Top F Thick	80.0000
Bot.F Width	1000.00	Bot.F Thick	80.0000
Area	218494	Asz	61694.2
Qyb	7078661	Qzb	125000
Iyy	402912888146	Izz	13335283140
Ybar	500.000	Zbar	1542.35
Wely	261232264	Welz	26670566
ry	1357.96	rz	247.048

2. Member Forces

Axial Force Fxx = 1412190 (LCB: 7+, POS:J)
Bending Moments My = 45455921240, Mz = 1171475193
End Moments Myi = 37575570477, Myj = 45455921240 (for Lb)
Myi = 37575570477, Myj = 45455921240 (for Ly)
Mzi = 889130780, Mzj = 1171475193 (for Lz)
Shear Forces Fyy = -1085173 (LCB: 7-, POS:I)
Fzz = -4451703 (LCB: 7-, POS:J)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/Nt_Rd = 1412190/73195557 = 0.019 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 45455921240/84469751106 = 0.538 < 1.000 .... O.K
M_Edz/M_Rdz = 1171475193/8934639704 = 0.131 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rmax = MAX[RNRd, (Rcom+Rbend)] = 0.689 < 1.000 .... O.K

Shear Resistance

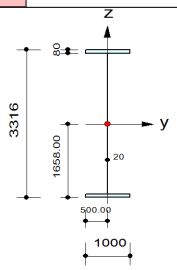
V_Edy/Vy_Rd = 0.035 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.623 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1330 (Memb:23, LCB: 4, POS: 911.8mm, Dir-Z)...................... O.K

1. Design Information

Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 24
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : concio A sx (No:7)
Position I : BH 3213.2x1000x20/80 (Tapered Section)
Position J : BH 3316x1000x20/80
Member Length : 1459.00



Depth	3316.00	Web Thick	20.0000
Top F Width	1000.00	Top F Thick	80.0000
Bot.F Width	1000.00	Bot.F Thick	80.0000
Area	223120	Asz	66320.0
Qyb	7717042	Qzb	125000
Iyy	471344540693	Izz	13335437333
Ybar	500.000	Zbar	1658.00
Wely	284285006	Welz	26670875
ry	1453.45	rz	244.475

2. Member Forces

Axial Force Fxx = 1278814 (LCB: 7+, POS:J)
Bending Moments My = 58297740378, Mz = 782520947
End Moments Myi = 53048998787, Myj = 58297740378 (for Lb)
Myi = 53048998787, Myj = 58297740378 (for Ly)
Mzi = 939604217, Mzj = 782520947 (for Lz)
Shear Forces Fyy = -1013669 (LCB: 7-, POS:J)
Fzz = -3835239 (LCB: 7-, POS:J)

3. Design Parameters

Unbraced Lengths Ly = 1459.00, Lz = 1459.00, Lb = 1459.00
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance
N_Ed/Nt_Rd = 1278814/74745200 = 0.017 < 1.000 .... O.K
Bending Resistance
M_Edy/M_Rdy = 58297740378/91104560285 = 0.640 < 1.000 .... O.K
M_Edz/M_Rdz = 782520947/8934743013 = 0.088 < 1.000 .... O.K
Combined Resistance
Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rmax = MAX[RNRd, (Rcom+Rbend)] = 0.745 < 1.000 .... O.K
Shear Resistance
V_Edy/Vy_Rd = 0.033 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.499 < 1.000 .... O.K

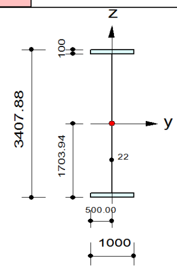
5. Deflection Checking Results

L/ 250.0 = 5.8360 > 0.0952 (Memb:24, LCB: 4, POS: 729.5mm, Dir-Z)..................... O.K

Company		Project Title	
or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information

Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 25
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : concio B sx (No:8)
Position I : BH 3366.11x1000x22/100 (Tapered Section)
Position J : BH 3407.88x1000x22/100
Member Length : 1823.50



Depth	3407.88	Web Thick	22.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	270573	Asz	74973.3
Qyb	8804209	Qzb	125000
Iyy	607788296337	Izz	16669513122
Ybar	500.000	Zbar	1703.94
Wely	356696220	Welz	33339026
ry	1498.77	rz	248.210

2. Member Forces

Axial Force Fxx = 1204011 (LCB: 7+, POS:J)
Bending Moments My = 71435648757, Mz = 1003722621
End Moments Myi = 66046199537, Myj = 71435648757 (for Lb)
Myi = 66046199537, Myj = 71435648757 (for Ly)
Mzi = 982292970, Mzj = 1003722621 (for Lz)
Shear Forces Fyy = -960341 (LCB: 7-, POS:I)
Fzz = -3268003 (LCB: 7-, POS:I)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

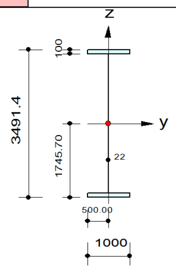
Axial Resistance
N_Ed/Nt_Rd = 1204011/90642048 = 0.013 < 1.000 .... O.K
Bending Resistance
M_Edy/M_Rdy = 71435648757/115514782257 = 0.618 < 1.000 .... O.K
M_Edz/M_Rdz = 1003722621/11168573792 = 0.090 < 1.000 .... O.K
Combined Resistance
Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rmax = MAX[RNRd, (Rcom+Rbend)] = 0.722 < 1.000 .... O.K
Shear Resistance
V_Edy/Vy_Rd = 0.025 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.348 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1382 (Memb:25, LCB: 4, POS: 911.7mm, Dir-Z)...................... O.K

Company		Project Title	
or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information



Design Code	: Eurocode3-2:05
Unit System	: N, mm
Member No	: 26
Material	: S355 (No:1)
	(Fy = 335.000, Es = 210000)
Section Name	: concio B sx (No:8)
Position I	: BH 3449.64x1000x22/100 (Tapered Section)
Position J	: BH 3491.4x1000x22/100
Member Length	: 1823.50

Depth	3491.40	Web Thick	22.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	272411	Asz	76810.9
Qyb	9061905	Qzb	125000
Iyy	640618845251	Izz	16669587239
Ybar	500.000	Zbar	1745.70
Wely	366969151	Welz	33339174
ry	1533.51	rz	247.372

2. Member Forces

Axial Force	Fxx = 969176 (LCB: 7+, POS:J)
Bending Moments	My = 80329466414, Mz = 992938540
End Moments	Myi = 76233362225, Myj = 80329466414 (for Lb)
	Myi = 76233362225, Myj = 80329466414 (for Ly)
	Mzi = 938102577, Mzj = 992938540 (for Lz)
Shear Forces	Fyy = -977804 (LCB: 7-, POS:I)
	Fzz = -2632485 (LCB: 7-, POS:I)

3. Design Parameters

Unbraced Lengths	Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors	Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors	Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/Nt_Rd = 969176/91257650 = 0.011 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 80329466414/118501012676 = 0.678 < 1.000 .... O.K

M_Edz/M_Rdz = 992938540/11168623450 = 0.089 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd

Rmax = MAX[RNRd, (Rcom+Rbend)] = 0.777 < 1.000 .... O.K

Shear Resistance

V_Edy/Vy_Rd = 0.025 < 1.000 .... O.K

V_Edz/Vz_Rd = 0.286 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1484 (Memb:26, LCB: 4, POS: 911.8mm, Dir-Z)...................... O.K

MIDAS/Civil **Steel Checking Result**

	Company		Project Title	
	or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information

Design Code : Eurocode3-2:05

Unit System : N, mm

Member No : 27

Material : S355 (No:1)

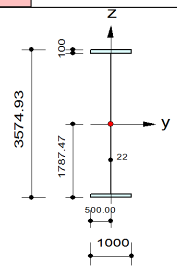
(Fy = 335.000, Es = 210000)

Section Name : concio B sx (No:8)

Position I : BH 3533.17x1000x22/100 (Tapered Section)

Position J : BH 3574.93x1000x22/100

Member Length : 1823.50



Depth	3574.93	Web Thick	22.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	274249	Asz	78648.5
Qyb	9321345	Qzb	125000
Iyy	674399691071	Izz	16669661357
Ybar	500.000	Zbar	1787.47
Wely	377293673	Welz	33339323
ry	1568.15	rz	246.542

2. Member Forces

Axial Force Fxx = 837246 (LCB: 7+, POS:J)

Bending Moments My = 86813869309, Mz = 1054723425

End Moments Myi = 84053202833, Myj = 86813869309 (for Lb)

Myi = 84053202833, Myj = 86813869309 (for Ly)

Mzi = 839077392, Mzj = 1054723425 (for Lz)

Shear Forces Fyy = -1030158 (LCB: 7-, POS:I)

Fzz = -2008221 (LCB: 7-, POS:I)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50

Effective Length Factors Ky = 1.00, Kz = 1.00

Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/Nt_Rd = 837246/91873252 = 0.009 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 86813869309/121486646395 = 0.715 < 1.000 .... O.K

M_Edz/M_Rdz = 1054723425/11168673109 = 0.094 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd

Rmax = MAX[RNRd, (Rcom+Rbend)] = 0.818 < 1.000 .... O.K

Shear Resistance

V_Edy/Vy_Rd = 0.027 < 1.000 .... O.K

V_Edz/Vz_Rd = 0.221 < 1.000 .... O.K

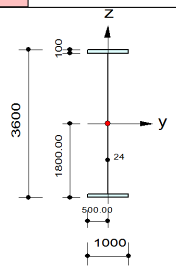
5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1532 (Memb:27, LCB: 4, POS: 911.8mm, Dir-Z)..................... O.K

Company		Project Title	
or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information

Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 28
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : concio C (No:6)
(Rolled : concio C).
Member Length : 1823.50



2. Member Forces

Axial Force Fxx = 823955 (LCB: 7+, POS:J)
Bending Moments My = 91006139972, Mz = 1050403802
End Moments Myi = 89538206189, Myj = 91006139972 (for Lb)
Myi = 89538206189, Myj = 91006139972 (for Ly)
Mzi = 826481778, Mzj = 1050403802 (for Lz)
Shear Forces Fyy = -1027104 (LCB: 7-, POS:I)
Fzz = -1405440 (LCB: 7-, POS:I)

Depth	3600.00	Web Thick	24.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	281600	Asz	86400.0
Qyb	8736667	Qzb	125000
Iyy	691274666667	Izz	16670583467
Ybar	500.000	Zbar	1800.00
Wely	384041481	Welz	33341167
ry	1566.78	rz	243.310

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/Nt_Rd = 823955/94336000 = 0.009 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 91006139972/124151897436 = 0.733 < 1.000 .... O.K

M_Edz/M_Rdz = 1050403802/11169290923 = 0.094 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd

Rmax = MAX[RNRd, (Rcom+Rbend)] = 0.836 < 1.000 .... O.K

Shear Resistance

V_Edy/Vy_Rd = 0.027 < 1.000 .... O.K

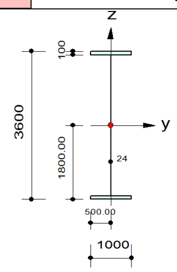
V_Edz/Vz_Rd = 0.140 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1553 (Memb:28, LCB: 4, POS: 911.8mm, Dir-Z)..................... O.K

1. Design Information

Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 29
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : concio C (No:6)
(Rolled : concio C).
Member Length : 1824.00



2. Member Forces

Axial Force Fxx = 715955 (LCB: 7+, POS:J)
Bending Moments My = 92363195567, Mz = 1029368169
End Moments Myi = 92195663786, Myj = 92363195567 (for Lb)
Myi = 92195663786, Myj = 92363195567 (for Ly)
Mzi = 906327347, Mzj = 1029368169 (for Lz)
Shear Forces Fyy = -967848 (LCB: 7-, POS:I)
Fzz = 671873 (LCB: 7+, POS:J)

Depth	3600.00	Web Thick	24.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	281600	Asz	86400.0
Qyb	8736667	Qzb	125000
Iyy	691274666667	Izz	16670583467
Ybar	500.000	Zbar	1800.00
Wely	384041481	Welz	33341167
ry	1566.78	rz	243.310

3. Design Parameters

Unbraced Lengths Ly = 1824.00, Lz = 1824.00, Lb = 1824.00
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/Nt_Rd = 715955/94336000 = 0.008 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 92363195567/124151897436 = 0.744 < 1.000 .... O.K

M_Edz/M_Rdz = 1029368169/11169290923 = 0.092 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd

Rmax = MAX[RNRd, (Rcom+Rbend)] = 0.844 < 1.000 .... O.K

Shear Resistance

V_Edy/Vy_Rd = 0.025 < 1.000 .... O.K

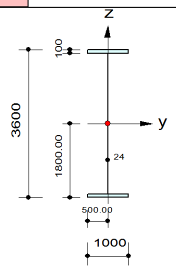
V_Edz/Vz_Rd = 0.083 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 7.2960 > 0.1585 (Memb:29, LCB: 4, POS: 912.0mm, Dir-Z)..................... O.K

	Company		Project Title	
	or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information



Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 30
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : concio C (No:6)
(Rolled : concio C).
Member Length : 1823.50

2. Member Forces

Depth	3600.00	Web Thick	24.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	281600	Asz	86400.0
Qyb	8736667	Qzb	125000
Iyy	691274666667	Izz	16670583467
Ybar	500.000	Zbar	1800.00
Wely	384041481	Welz	33341167
ry	1566.78	rz	243.310

Axial Force Fxx = 603238 (LCB: 7+, POS:I)
Bending Moments My = 92279178926, Mz = 947560073
End Moments Myi = 92279178926, Myj = 91159758992 (for Lb)
Myi = 92279178926, Myj = 91159758992 (for Ly)
Mzi = 947560073, Mzj = 985529732 (for Lz)
Shear Forces Fyy = -900549 (LCB: 7-, POS:I)
Fzz = 1274673 (LCB: 7+, POS:J)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/Nt_Rd = 603238/94336000 = 0.006 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 92279178926/124151897436 = 0.743 < 1.000 .... O.K

M_Edz/M_Rdz = 947560073/11169290923 = 0.085 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd

Rmax = MAX[RNRd, (Rcom+Rbend)] = 0.835 < 1.000 .... O.K

Shear Resistance

V_Edy/Vy_Rd = 0.023 < 1.000 .... O.K

V_Edz/Vz_Rd = 0.156 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1571 (Memb:30, LCB: 4, POS: 911.8mm, Dir-Z)...................... O.K

MIDAS/Civil **Steel Checking Result**

	Company		Project Title	
	or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information

Design Code : Eurocode3-2:05

Unit System : N, mm

Member No : 31

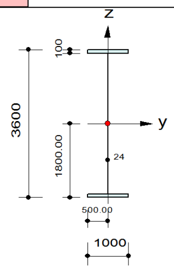
Material : S355 (No:1)

(Fy = 335.000, Es = 210000)

Section Name : concio C (No:6)

(Rolled : concio C).

Member Length : 729.000



2. Member Forces

Axial Force Fxx = 396934 (LCB: 7+, POS:I)

Bending Moments My = 89542830466, Mz = 868328549

End Moments Myi = 89542830466, Myj = 88435972308 (for Lb)

Myi = 89542830466, Myj = 88435972308 (for Ly)

Mzi = 868328549, Mzj = 413868994 (for Lz)

Shear Forces Fyy = -855769 (LCB: 7-, POS:I)

Fzz = 1830669 (LCB: 7+, POS:I)

Depth	3600.00	Web Thick	24.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	281600	Asz	86400.0
Qyb	8736667	Qzb	125000
Iyy	691274666667	Izz	16670583467
Ybar	500.000	Zbar	1800.00
Wely	384041481	Welz	33341167
ry	1566.78	rz	243.310

3. Design Parameters

Unbraced Lengths Ly = 729.000, Lz = 729.000, Lb = 729.000

Effective Length Factors Ky = 1.00, Kz = 1.00

Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/Nt_Rd = 396934/94336000 = 0.004 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 89542830466/124151897436 = 0.721 < 1.000 .... O.K

M_Edz/M_Rdz = 868328549/11169290923 = 0.078 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd

Rmax = MAX[RNRd, (Rcom+Rbend)] = 0.803 < 1.000 .... O.K

Shear Resistance

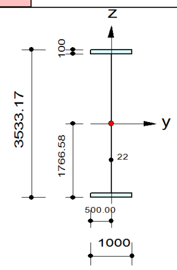
V_Edy/Vy_Rd = 0.022 < 1.000 .... O.K

V_Edz/Vz_Rd = 0.157 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 2.9160 > 0.0244 (Memb:31, LCB: 4, POS: 364.5mm, Dir-Z)...................... O.K

1. Design Information



Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 32
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : Concio B dx (No:10)
Position I : BH 3533.17x1000x22/100 (Tapered Section)
Position J : BH 3491.4x1000x22/100
Member Length : 1823.50

Depth	3533.17	Web Thick	22.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	273330	Asz	77729.7
Qyb	9191407	Qzb	125000
Iyy	657390080394	Izz	16669624298
Ybar	500.000	Zbar	1766.58
Wely	372124965	Welz	33339249
ry	1550.84	rz	246.956

2. Member Forces

Axial Force Fxx = 289291 (LCB: 7+, POS:I)
Bending Moments My = 84527738891, Mz = 771597258
End Moments Myi = 84527738891, Myj = 80814955852 (for Lb)
Myi = 84527738891, Myj = 80814955852 (for Ly)
Mzi = 771597258, Mzj = 993685219 (for Lz)
Shear Forces Fyy = -945339 (LCB: 7-, POS:I)
Fzz = 2443049 (LCB: 7+, POS:I)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance
N_Ed/Nt_Rd = 289291/91565451 = 0.003 < 1.000 .... O.K
Bending Resistance
M_Edy/M_Rdy = 84527738891/119993904124 = 0.704 < 1.000 .... O.K
M_Edz/M_Rdz = 771597258/11168648280 = 0.069 < 1.000 .... O.K
Combined Resistance
Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rmax = MAX[RNRd, (Rcom+Rbend)] = 0.777 < 1.000 .... O.K
Shear Resistance
V_Edy/Vy_Rd = 0.024 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.325 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1503 (Memb:32, LCB: 4, POS: 911.8mm, Dir-Z)..................... O.K

MIDAS/Civil **Steel Checking Result**

	Company		Project Title	
	or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information

Design Code : Eurocode3-2:05

Unit System : N, mm

Member No : 33

Material : S355 (No:1)

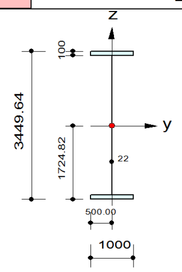
(Fy = 335.000, Es = 210000)

Section Name : Concio B dx (No:10)

Position I : BH 3449.64x1000x22/100 (Tapered Section)

Position J : BH 3407.88x1000x22/100

Member Length : 1823.50



Depth	3449.64	Web Thick	22.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	271492	Asz	75892.1
Qyb	8932839	Qzb	125000
Iyy	624085184335	Izz	16669550181
Ybar	500.000	Zbar	1724.82
Wely	361826235	Welz	33339100
ry	1516.15	rz	247.790

2. Member Forces

Axial Force Fxx = 295674 (LCB: 7+, POS:I)

Bending Moments My = 77092650756, Mz = 807394077

End Moments Myi = 77092650756, Myj = 72043680822 (for Lb)

Myi = 77092650756, Myj = 72043680822 (for Ly)

Mzi = 807394077, Mzj = 1080062954 (for Lz)

Shear Forces Fyy = -1015861 (LCB: 7-, POS:I)

Fzz = 3075019 (LCB: 7+, POS:I)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50

Effective Length Factors Ky = 1.00, Kz = 1.00

Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/Nt_Rd = 295674/90949849 = 0.003 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 77092650756/117007972024 = 0.659 < 1.000 .... O.K

M_Edz/M_Rdz = 807394077/11168598621 = 0.072 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd

Rmax = MAX[RNRd, (Rcom+Rbend)] = 0.734 < 1.000 .... O.K

Shear Resistance

V_Edy/Vy_Rd = 0.026 < 1.000 .... O.K

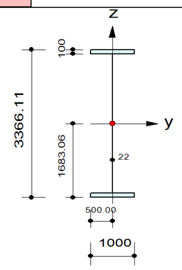
V_Edz/Vz_Rd = 0.391 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1426 (Memb:33, LCB: 4, POS: 911.8mm, Dir-Z)...................... O.K

1. Design Information

Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 34
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : Concio B dx (No:10)
Position I : BH 3366.11x1000x22/100 (Tapered Section)
Position J : BH 3324.35x1000x22/100
Member Length : 1823.50



Depth	3366.11	Web Thick	22.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	269654	Asz	74054.5
Qyb	8676016	Qzb	125000
Iyy	591727379947	Izz	16669476064
Ybar	500.000	Zbar	1683.06
Wely	351579112	Welz	33338952
ry	1481.35	rz	248.632

2. Member Forces

Axial Force Fxx = 203794 (LCB: 7+, POS:I)
Bending Moments My = 66770674235, Mz = 867102429
End Moments Myi = 66770674235, Myj = 60417637622 (for Lb)
Myi = 66770674235, Myj = 60417637622 (for Ly)
Mzi = 867102429, Mzj = 1083065396 (for Lz)
Shear Forces Fyy = -986711 (LCB: 7-, POS:I)
Fzz = 3706410 (LCB: 7+, POS:I)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance
N_Ed/Nt_Rd = 203794/90334247 = 0.002 < 1.000 .... O.K
Bending Resistance
M_Edy/M_Rdy = 66770674235/114021443583 = 0.586 < 1.000 .... O.K
M_Edz/M_Rdz = 867102429/11168548963 = 0.078 < 1.000 .... O.K
Combined Resistance
Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rmax = MAX[RNRd, (Rcom+Rbend)] = 0.665 < 1.000 .... O.K
Shear Resistance
V_Edy/Vy_Rd = 0.026 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.444 < 1.000 .... O.K

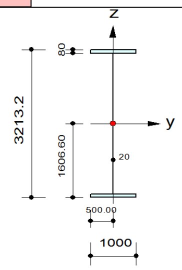
5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1283 (Memb:34, LCB: 4, POS: 911.7mm, Dir-Z)...................... O.K

MIDAS/Civil — Steel Checking Result

Company		Project Title	
or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information



Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 35
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : Concio A dx (No:9)
Position I : BH 3213.2x1000x20/80 (Tapered Section)
Position J : BH 3084.71x1000x20/80
Member Length : 1823.50

Depth	3213.20	Web Thick	20.0000
Top F Width	1000.00	Top F Thick	80.0000
Bot.F Width	1000.00	Bot.F Thick	80.0000
Area	221064	Asz	64263.9
Qyb	7431644	Qzb	125000
Iyy	440198721350	Izz	13335368798
Ybar	500.000	Zbar	1606.60
Wely	273994264	Welz	26670738
ry	1411.12	rz	245.609

2. Member Forces

Axial Force Fxx = 35565.8 (LCB: 7+, POS:I)
Bending Moments My = 53868553108, Mz = 779072100
End Moments Myi = 53868553108, Myj = 46261367165 (for Lb)
Myi = 53868553108, Myj = 46261367165 (for Ly)
Mzi = 779072100, Mzj = 1030874756 (for Lz)
Shear Forces Fyy = -962996 (LCB: 7-, POS:I)
Fzz = 4327904 (LCB: 7+, POS:I)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance
N_Ed/Nt_Rd = 35566/74056417 = 0.000 < 1.000 .... O.K

Bending Resistance
M_Edy/M_Rdy = 53868553108/88157332511 = 0.611 < 1.000 .... O.K
M_Edz/M_Rdz = 779072100/8934697094 = 0.087 < 1.000 .... O.K

Combined Resistance
Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rmax = MAX[RNRd, (Rcom+Rbend)] = 0.699 < 1.000 .... O.K

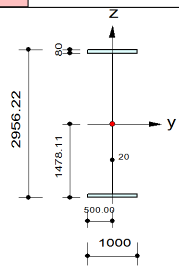
Shear Resistance
V_Edy/Vy_Rd = 0.031 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.689 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1395 (Memb:35, LCB: 4, POS: 911.8mm, Dir-Z)..................... O.K

Company		Project Title	
or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information



Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 36
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : Concio A dx (No:9)
Position I : BH 2956.22x1000x20/80 (Tapered Section)
Position J : BH 2827.74x1000x20/80
Member Length : 1823.50

Depth	2956.22	Web Thick	20.0000
Top F Width	1000.00	Top F Thick	80.0000
Bot.F Width	1000.00	Bot.F Thick	80.0000
Area	215924	Asz	59124.5
Qyb	6729805	Qzb	125000
Iyy	367430594595	Izz	13335197482
Ybar	500.000	Zbar	1478.11
Wely	248581076	Welz	26670395
ry	1304.48	rz	248.513

2. Member Forces

Axial Force Fxx = -53330 (LCB: 7+, POS:I)
Bending Moments My = 38432380014, Mz = 744916887
End Moments Myi = 38432380014, Myj = 29557827860 (for Lb)
Myi = 38432380014, Myj = 29557827860 (for Ly)
Mzi = 744916887, Mzj = 1046451772 (for Lz)
Shear Forces Fyy = -961126 (LCB: 7-, POS:I)
Fzz = 4957320 (LCB: 7+, POS:I)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance
N_Ed/MIN[Nc_Rd, Nb_Rd] = 53330/59497567 = 0.001 < 1.000 .... O.K
Bending Resistance
M_Edy/M_Rdy = 38432380014/80786800463 = 0.476 < 1.000 .... O.K
M_Edz/M_Rdz = 744916887/8934582313 = 0.083 < 1.000 .... O.K
Combined Resistance
Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rc_LT1 = N_Ed/(Xiy*Aeff*fy/Gamma_M1)
Rb_LT1 = kyy*(M_Edy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kyz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rc_LT2 = N_Ed/(Xiz*Aeff*fy/Gamma_M1)
Rb_LT2 = kzy*(M_Edzy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kzz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rmax = MAX[Rcom+Rbend, MAX(Rc_LT1+Rb_LT1, Rc_LT2+Rb_LT2)] = 0.616 < 1.000 .... O.K
Shear Resistance
V_Edy/Vy_Rd = 0.031 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.732 < 1.000 .... O.K

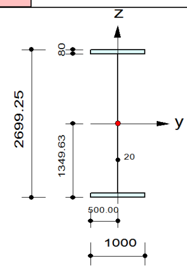
5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1139 (Memb:36, LCB: 4, POS: 911.8mm, Dir-Z)..................... O.K

Company		Project Title	
or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information

Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 37
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : Concio A dx (No:9)
Position I : BH 2699.25x1000x20/80 (Tapered Section)
Position J : BH 2570.76x1000x20/80
Member Length : 1823.50



Depth	2699.25	Web Thick	20.0000
Top F Width	1000.00	Top F Thick	80.0000
Bot.F Width	1000.00	Bot.F Thick	80.0000
Area	210785	Asz	53985.0
Qyb	6044474	Qzb	125000
Iyy	301791780006	Izz	13335026167
Ybar	500.000	Zbar	1349.63
Wely	223611568	Welz	26670052
ry	1196.56	rz	251.523

2. Member Forces

Axial Force Fxx = -158933 (LCB: 7+, POS:I)
Bending Moments My = 20399352729, Mz = 689093408
End Moments Myi = 20399352729, Myj = 10266789949 (for Lb)
Myi = 20399352729, Myj = 10266789949 (for Ly)
Mzi = 689093408, Mzj = 1013960352 (for Lz)
Shear Forces Fyy = -891188 (LCB: 7-, POS:I)
Fzz = 5587352 (LCB: 7+, POS:I)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/MIN[Nc_Rd, Nb_Rd] = 158933/59449273 = 0.003 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 20399352729/73411302212 = 0.278 < 1.000 .... O.K
M_Edz/M_Rdz = 689093408/8934467532 = 0.077 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rc_LT1 = N_Ed/(Xiy*Aeff*fy/Gamma_M1)
Rb_LT1 = kyy*(M_Edy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kyz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rc_LT2 = N_Ed/(Xiz*Aeff*fy/Gamma_M1)
Rb_LT2 = kzy*(M_Edzy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kzz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rmax = MAX[Rcom+Rbend, MAX(Rc_LT1+Rb_LT1, Rc_LT2+Rb_LT2)] = 0.393 < 1.000 .... O.K

Shear Resistance

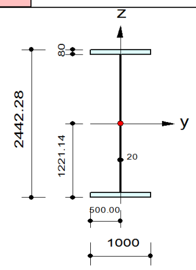
V_Edy/Vy_Rd = 0.029 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.777 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.0631 (Memb:37, LCB: 4, POS: 911.8mm, Dir-Z)..................... O.K

1. Design Information

Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 38
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : Concio A dx (No:9)
Position I : BH 2442.28x1000x20/80 (Tapered Section)
Position J : BH 2400x1000x20/80
Member Length : 600.000



Depth	2442.28	Web Thick	20.0000
Top F Width	1000.00	Top F Thick	80.0000
Bot.F Width	1000.00	Bot.F Thick	80.0000
Area	205646	Asz	48845.5
Qyb	5375652	Qzb	125000
Iyy	243112584692	Izz	13334854851
Ybar	500.000	Zbar	1221.14
Wely	199086830	Welz	26669710
ry	1087.29	rz	254.645

2. Member Forces

Axial Force Fxx = -39252 (LCB: 7-, POS:I)
Bending Moments My = -309320314, Mz = -675920901
End Moments Myi = -309320314, Myj = -76665878 (for Lb)
Myi = -309320314, Myj = -76665878 (for Ly)
Mzi = -675920901, Mzj = -600960627 (for Lz)
Shear Forces Fyy = -1185603 (LCB: 7-, POS:I)
Fzz = -478921 (LCB: 7-, POS:I)

3. Design Parameters

Unbraced Lengths Ly = 600.000, Lz = 600.000, Lb = 600.000
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/MIN[Nc_Rd, Nb_Rd] = 39252/59390105 = 0.001 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 309320314/66030984895 = 0.005 < 1.000 .... O.K
M_Edz/M_Rdz = 675920901/8934352750 = 0.076 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rc_LT1 = N_Ed/(Xiy*Aeff*fy/Gamma_M1)
Rb_LT1 = kyy*(M_Edy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kyz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rc_LT2 = N_Ed/(Xiz*Aeff*fy/Gamma_M1)
Rb_LT2 = kzy*(M_Edzy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kzz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rmax = MAX[Rcom+Rbend, MAX(Rc_LT1+Rb_LT1, Rc_LT2+Rb_LT2)] = 0.089 < 1.000 .... O.K

Shear Resistance

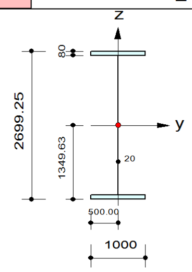
V_Edy/Vy_Rd = 0.038 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.050 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 2.4000 > 0.0002 (Memb:38, LCB: 4, POS: 300.0mm, Dir-Z)..................... O.K

	Company		Project Title	
	or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information



Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 140
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : concio A sx (No:7)
Position I : BH 2570.76x1000x20/80 (Tapered Section)
Position J : BH 2699.25x1000x20/80
Member Length : 1823.50

Depth	2699.25	Web Thick	20.0000
Top F Width	1000.00	Top F Thick	80.0000
Bot.F Width	1000.00	Bot.F Thick	80.0000
Area	210785	Asz	53985.0
Qyb	6044474	Qzb	125000
Iyy	301791780006	Izz	13335026167
Ybar	500.000	Zbar	1349.63
Wely	223611568	Welz	26670052
ry	1196.56	rz	251.523

2. Member Forces

Axial Force Fxx = 1117599 (LCB: 7+, POS:J)
Bending Moments My = 19869769218, Mz = 740342876
End Moments Myi = 10631487583, Myj = 19869769218 (for Lb)
Myi = 10631487583, Myj = 19869769218 (for Ly)
Mzi = 491567404, Mzj = 740342876 (for Lz)
Shear Forces Fyy = -955253 (LCB: 7-, POS:I)
Fzz = -5848682 (LCB: 7-, POS:I)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/Nt_Rd = 1117599/70612976 = 0.016 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 19869769218/73411302212 = 0.271 < 1.000 .... O.K

M_Edz/M_Rdz = 740342876/8934467532 = 0.083 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd

Rmax = MAX[RNRd, (Rcom+Rbend)] = 0.338 < 1.000 .... O.K

Shear Resistance

V_Edy/Vy_Rd = 0.031 < 1.000 .... O.K

V_Edz/Vz_Rd = 0.795 < 1.000 .... O.K

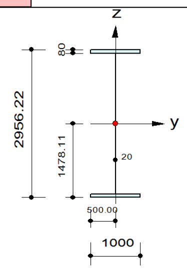
5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.0621 (Memb:140, LCB: 4, POS: 911.8mm, Dir-Z).................... O.K

Company		Project Title	
or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information

Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 141
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : concio A sx (No:7)
Position I : BH 2827.74x1000x20/80 (Tapered Section)
Position J : BH 2956.22x1000x20/80
Member Length : 1823.50



Depth	2956.22	Web Thick	20.0000
Top F Width	1000.00	Top F Thick	80.0000
Bot.F Width	1000.00	Bot.F Thick	80.0000
Area	215924	Asz	59124.5
Qyb	6729805	Qzb	125000
Iyy	367430594595	Izz	13335197482
Ybar	500.000	Zbar	1478.11
Wely	248581076	Welz	26670395
ry	1304.48	rz	248.513

2. Member Forces

Axial Force Fxx = 1024266 (LCB: 7+, POS:J)
Bending Moments My = 38460267602, Mz = 780419982
End Moments Myi = 29359900259, Myj = 38460267602 (for Lb)
Myi = 29359900259, Myj = 38460267602 (for Ly)
Mzi = 490187889, Mzj = 780419982 (for Lz)
Shear Forces Fyy = -956993 (LCB: 7-, POS:I)
Fzz = -5149926 (LCB: 7-, POS:J)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

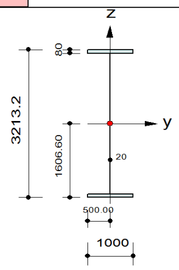
Axial Resistance
N_Ed/Nt_Rd = 1024266/72334697 = 0.014 < 1.000 .... O.K
Bending Resistance
M_Edy/M_Rdy = 38460267602/80786800463 = 0.476 < 1.000 .... O.K
M_Edz/M_Rdz = 780419982/8934582313 = 0.087 < 1.000 .... O.K
Combined Resistance
Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rmax = MAX[RNRd, (Rcom+Rbend)] = 0.489 < 1.000 .... O.K
Shear Resistance
V_Edy/Vy_Rd = 0.031 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.714 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1192 (Memb:141, LCB: 4, POS: 911.8mm, Dir-Z).................... O.K

1. Design Information

Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 142
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : concio A sx (No:7)
Position I : BH 3084.71x1000x20/80 (Tapered Section)
Position J : BH 3213.2x1000x20/80
Member Length : 1823.50



Depth	3213.20	Web Thick	20.0000
Top F Width	1000.00	Top F Thick	80.0000
Bot.F Width	1000.00	Bot.F Thick	80.0000
Area	221064	Asz	64263.9
Qyb	7431644	Qzb	125000
Iyy	440198721350	Izz	13335368798
Ybar	500.000	Zbar	1606.60
Wely	273994264	Welz	26670738
ry	1411.12	rz	245.609

2. Member Forces

Axial Force Fxx = 914725 (LCB: 7+, POS:J)
Bending Moments My = 54437581534, Mz = 818279281
End Moments Myi = 46628803896, Myj = 54437581534 (for Lb)
Myi = 46628803896, Myj = 54437581534 (for Ly)
Mzi = 473676402, Mzj = 818279281 (for Lz)
Shear Forces Fyy = -969752 (LCB: 7-, POS:I)
Fzz = -4237835 (LCB: 10, POS:J)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance
N_Ed/Nt_Rd = 914725/74056417 = 0.012 < 1.000 .... O.K
Bending Resistance
M_Edy/M_Rdy = 54437581534/88157332511 = 0.618 < 1.000 .... O.K
M_Edz/M_Rdz = 818279281/8934697094 = 0.092 < 1.000 .... O.K
Combined Resistance
Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rmax = MAX[RNRd, (Rcom+Rbend)] = 0.721 < 1.000 .... O.K
Shear Resistance
V_Edy/Vy_Rd = 0.031 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.671 < 1.000 .... O.K

5. Deflection Checking Results

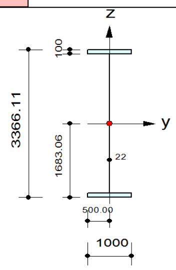
L/ 250.0 = 7.2940 > 0.1483 (Memb:142, LCB: 4, POS: 911.7mm, Dir-Z).................... O.K

MIDAS/Civil **Steel Checking Result**

	Company		Project Title	
	or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information

Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 143
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : concio B sx (No:8)
Position I : BH 3324.35x1000x22/100 (Tapered Section)
Position J : BH 3366.11x1000x22/100
Member Length : 1823.50



Depth	3366.11	Web Thick	22.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	269654	Asz	74054.5
Qyb	8676016	Qzb	125000
Iyy	591727379947	Izz	16669476064
Ybar	500.000	Zbar	1683.06
Wely	351579112	Welz	33338952
ry	1481.35	rz	248.632

2. Member Forces

Axial Force Fxx = 883036 (LCB: 7+, POS:J)
Bending Moments My = 67883207631, Mz = 900983034
End Moments Myi = 61327020285, Myj = 67883207631 (for Lb)
Myi = 61327020285, Myj = 67883207631 (for Ly)
Mzi = 375483737, Mzj = 900983034 (for Lz)
Shear Forces Fyy = -1000882 (LCB: 7-, POS:I)
Fzz = -3660200 (LCB: 10, POS:J)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

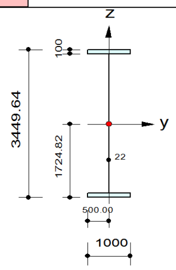
Axial Resistance
N_Ed/Nt_Rd = 883036/90334247 = 0.010 < 1.000 .... O.K
Bending Resistance
M_Edy/M_Rdy = 67883207631/114021443583 = 0.595 < 1.000 .... O.K
M_Edz/M_Rdz = 900983034/11168548963 = 0.081 < 1.000 .... O.K
Combined Resistance
Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rmax = MAX[RNRd, (Rcom+Rbend)] = 0.686 < 1.000 .... O.K
Shear Resistance
V_Edy/Vy_Rd = 0.026 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.438 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1373 (Memb:143, LCB: 4, POS: 911.7mm, Dir-Z).................... O.K

Company		**Project Title**	
or		**File Name**	C:\...\cavalcavia_rev4.mcb

1. Design Information



Design Code	: Eurocode3-2:05
Unit System	: N, mm
Member No	: 144
Material	: S355 (No:1)
	(Fy = 335.000, Es = 210000)
Section Name	: concio B sx (No:8)
Position I	: BH 3407.88x1000x22/100 (Tapered Section)
Position J	: BH 3449.64x1000x22/100
Member Length	: 1823.50

Depth	3449.64	Web Thick	22.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	271492	Asz	75892.1
Qyb	8932839	Qzb	125000
Iyy	624085184335	Izz	16669550181
Ybar	500.000	Zbar	1724.82
Wely	361826235	Welz	33339100
ry	1516.15	rz	247.790

2. Member Forces

Axial Force	Fxx = -1461565 (LCB: 10, POS:J)
Bending Moments	My = 76759307302, Mz = 303297601
End Moments	Myi = 71169881228, Myj = 76759307302 (for Lb)
	Myi = 71169881228, Myj = 76759307302 (for Ly)
	Mzi = -83999232, Mzj = 303297601 (for Lz)
Shear Forces	Fyy = -1029534 (LCB: 7-, POS:I)
	Fzz = -3038462 (LCB: 10, POS:J)

3. Design Parameters

Unbraced Lengths	Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors	Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors	Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/MIN[Nc_Rd, Nb_Rd] = 1461565/74166937 = 0.020 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 76759307302/117007972024 = 0.656 < 1.000 .... O.K

M_Edz/M_Rdz = 303297601/11168598621 = 0.027 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd

Rc_LT1 = N_Ed/(Xiy*Aeff*fy/Gamma_M1)

Rb_LT1 = kyy*(M_Edy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kyz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)

Rc_LT2 = N_Ed/(Xiz*Aeff*fy/Gamma_M1)

Rb_LT2 = kzy*(M_Edzy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kzz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)

Rmax = MAX[Rcom+Rbend, MAX(Rc_LT1+Rb_LT1, Rc_LT2+Rb_LT2)] = 0.773 < 1.000 .... O.K

Shear Resistance

V_Edy/Vy_Rd = 0.027 < 1.000 .... O.K

V_Edz/Vz_Rd = 0.390 < 1.000 .... O.K

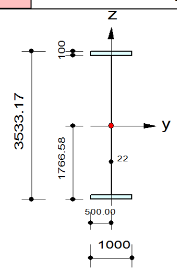
5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1533 (Memb:144, LCB: 4, POS: 911.8mm, Dir-Z).................... O.K

Company		Project Title	
or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information

Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 145
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : concio B sx (No:8)
Position I : BH 3491.4x1000x22/100 (Tapered Section)
Position J : BH 3533.17x1000x22/100
Member Length : 1823.50



Depth	3533.17	Web Thick	22.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	273330	Asz	77729.7
Qyb	9191407	Qzb	125000
Iyy	657390080394	Izz	16669624298
Ybar	500.000	Zbar	1766.58
Wely	372124965	Welz	33339249
ry	1550.84	rz	246.956

2. Member Forces

Axial Force Fxx = -1510821 (LCB: 10, POS:J)
Bending Moments My = 85702450563, Mz = 253993434
End Moments Myi = 81263078405, Myj = 85702450563 (for Lb)
Myi = 81263078405, Myj = 85702450563 (for Ly)
Mzi = 112702418, Mzj = 253993434 (for Lz)
Shear Forces Fyy = -1025318 (LCB: 7-, POS:I)
Fzz = -2407645 (LCB: 10, POS:J)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance
N_Ed/MIN[Nc_Rd, Nb_Rd] = 1510821/74180633 = 0.020 < 1.000 .... O.K
Bending Resistance
M_Edy/M_Rdy = 85702450563/119989861358 = 0.714 < 1.000 .... O.K
M_Edz/M_Rdz = 253993434/11168648280 = 0.023 < 1.000 .... O.K
Combined Resistance
Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rc_LT1 = N_Ed/(Xiy*Aeff*fy/Gamma_M1)
Rb_LT1 = kyy*(M_Edy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kyz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rc_LT2 = N_Ed/(Xiz*Aeff*fy/Gamma_M1)
Rb_LT2 = kzy*(M_Edzy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kzz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rmax = MAX[Rcom+Rbend, MAX(Rc_LT1+Rb_LT1, Rc_LT2+Rb_LT2)] = 0.833 < 1.000 .... O.K
Shear Resistance
V_Edy/Vy_Rd = 0.027 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.329 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1619 (Memb:145, LCB: 4, POS: 911.8mm, Dir-Z)..................... O.K

Company		Project Title	
or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information

Design Code : Eurocode3-2:05

Unit System : N, mm

Member No : 146

Material : S355 (No:1)

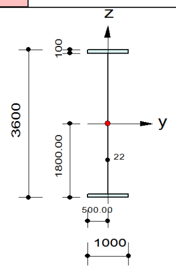
(Fy = 335.000, Es = 210000)

Section Name : concio B sx (No:8)

Position I : BH 3574.93x1000x22/100 (Tapered Section)

Position J : BH 3600x1000x22/100

Member Length : 1094.50



Depth	3600.00	Web Thick	22.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	274800	Asz	79200.0
Qyb	9399545	Qzb	125000
Iyy	684724000000	Izz	16669683600
Ybar	500.000	Zbar	1800.00
Wely	380402222	Welz	33339367
ry	1578.52	rz	246.295

2. Member Forces

Axial Force Fxx = -1465616 (LCB: 10, POS:J)

Bending Moments My = 90855017275, Mz = -234227176

End Moments Myi = 89248190908, Myj = 90855017275 (for Lb)

Myi = 89248190908, Myj = 90855017275 (for Ly)

Mzi = -199133730, Mzj = -234227176 (for Lz)

Shear Forces Fyy = -931025 (LCB: 7-, POS:I)

Fzz = -1722706 (LCB: 9, POS:I)

3. Design Parameters

Unbraced Lengths Ly = 1094.50, Lz = 1094.50, Lb = 1094.50

Effective Length Factors Ky = 1.00, Kz = 1.00

Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/MIN[Nc_Rd, Nb_Rd] = 1465616/74191106 = 0.020 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 90855017275/122382547617 = 0.742 < 1.000 .... O.K

M_Edz/M_Rdz = 234227176/11168688012 = 0.021 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd

Rc_LT1 = N_Ed/(Xiy*Aeff*fy/Gamma_M1)

Rb_LT1 = kyy*(M_Edy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kyz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)

Rc_LT2 = N_Ed/(Xiz*Aeff*fy/Gamma_M1)

Rb_LT2 = kzy*(M_Edzy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kzz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)

Rmax = MAX[Rcom+Rbend, MAX(Rc_LT1+Rb_LT1, Rc_LT2+Rb_LT2)] = 0.861 < 1.000 .... O.K

Shear Resistance

V_Edy/Vy_Rd = 0.024 < 1.000 .... O.K

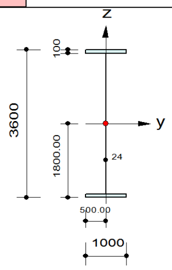
V_Edz/Vz_Rd = 0.195 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 4.3780 > 0.0594 (Memb:146, LCB: 4, POS: 547.3mm, Dir-Z).................... O.K

Company		**Project Title**	
or		**File Name**	C:\...\cavalcavia_rev4.mcb

1. Design Information



Design Code : Eurocode3-2:05

Unit System : N, mm

Member No : 147

Material : S355 (No:1)

(Fy = 335.000, Es = 210000)

Section Name : concio C (No:6)

(Rolled : concio C).

Member Length : 1823.50

2. Member Forces

Depth	3600.00	Web Thick	24.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	281600	Asz	86400.0
Qyb	8736667	Qzb	125000
Iyy	691274666667	Izz	16670583467
Ybar	500.000	Zbar	1800.00
Wely	384041481	Welz	33341167
ry	1566.78	rz	243.310

Axial Force Fxx = -1210376 (LCB: 10, POS:J)

Bending Moments My = 93017116123, Mz = 675744121

End Moments Myi = 92765934448, Myj = 93017116123 (for Lb)

Myi = 92765934448, Myj = 93017116123 (for Ly)

Mzi = -538387476, Mzj = 675744121 (for Lz)

Shear Forces Fyy = -905340 (LCB: 7-, POS:I)

Fzz = -1391203 (LCB: 7-, POS:I)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50

Effective Length Factors Ky = 1.00, Kz = 1.00

Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/MIN[Nc_Rd, Nb_Rd] = 1210376/75501496 = 0.016 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 93017116123/124151897436 = 0.749 < 1.000 .... O.K

M_Edz/M_Rdz = 675744121/11169290923 = 0.061 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd

Rc_LT1 = N_Ed/(Xiy*Aeff*fy/Gamma_M1)

Rb_LT1 = kyy*(M_Edy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kyz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)

Rc_LT2 = N_Ed/(Xiz*Aeff*fy/Gamma_M1)

Rb_LT2 = kzy*(M_Edzy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kzz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)

Rmax = MAX[Rcom+Rbend, MAX(Rc_LT1+Rb_LT1, Rc_LT2+Rb_LT2)] = 0.908 < 1.000 .... O.K

Shear Resistance

V_Edy/Vy_Rd = 0.023 < 1.000 .... O.K

V_Edz/Vz_Rd = 0.140 < 1.000 .... O.K

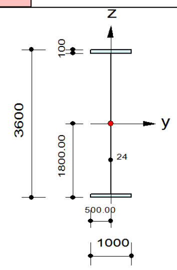
5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1695 (Memb:147, LCB: 4, POS: 911.8mm, Dir-Z).................... O.K

Company		Project Title	
Author		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information

Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 148
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : concio C (No:6)
(Rolled : concio C).
Member Length : 1824.00



2. Member Forces

Axial Force Fxx = -1106664 (LCB: 9, POS:I)
Bending Moments My = 95399669505, Mz = -707878030
End Moments Myi = 95399669505, Myj = 94859386415 (for Lb)
Myi = 95399669505, Myj = 94859386415 (for Ly)
Mzi = -707878030, Mzj = 267436984 (for Lz)
Shear Forces Fyy = -970435 (LCB: 7-, POS:I)
Fzz = 902913 (LCB: 7+, POS:J)

Depth	3600.00	Web Thick	24.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	281600	Asz	86400.0
Qyb	8736667	Qzb	125000
Iyy	691274666667	Izz	16670583467
Ybar	500.000	Zbar	1800.00
Wely	384041481	Welz	33341167
ry	1566.78	rz	243.310

3. Design Parameters

Unbraced Lengths Ly = 1824.00, Lz = 1824.00, Lb = 1824.00
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/MIN[Nc_Rd, Nb_Rd] = 1106664/75501496 = 0.015 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 95399669505/124151897436 = 0.768 < 1.000 .... O.K

M_Edz/M_Rdz = 707878030/11169290923 = 0.063 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd

Rc_LT1 = N_Ed/(Xiy*Aeff*fy/Gamma_M1)

Rb_LT1 = kyy*(M_Edy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kyz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)

Rc_LT2 = N_Ed/(Xiz*Aeff*fy/Gamma_M1)

Rb_LT2 = kzy*(M_Edzy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kzz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)

Rmax = MAX[Rcom+Rbend, MAX(Rc_LT1+Rb_LT1, Rc_LT2+Rb_LT2)] = 0.931 < 1.000 .... O.K

Shear Resistance

V_Edy/Vy_Rd = 0.025 < 1.000 .... O.K

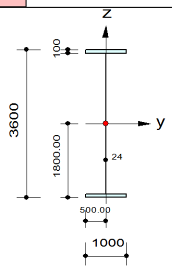
V_Edz/Vz_Rd = 0.114 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 7.2960 > 0.1710 (Memb:148, LCB: 4, POS: 912.0mm, Dir-Z).................... O.K

1. Design Information

Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 149
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : concio C (No:6)
(Rolled : concio C).
Member Length : 1823.50



2. Member Forces

Axial Force Fxx = -1007119 (LCB: 9, POS:I)
Bending Moments My = 93002696666, Mz = -498948004
End Moments Myi = 93002696666, Myj = 90768989365 (for Lb)
Myi = 93002696666, Myj = 90768989365 (for Ly)
Mzi = -498948004, Mzj = 625667234 (for Lz)
Shear Forces Fyy = -1023761 (LCB: 7-, POS:I)
Fzz = 1524852 (LCB: 7+, POS:J)

Depth	3600.00	Web Thick	24.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	281600	Asz	86400.0
Qyb	8736667	Qzb	125000
Iyy	691274666667	Izz	16670583467
Ybar	500.000	Zbar	1800.00
Wely	384041481	Welz	33341167
ry	1566.78	rz	243.310

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/MIN[Nc_Rd, Nb_Rd] = 1007119/75501496 = 0.013 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 93002696666/124151897436 = 0.749 < 1.000 .... O.K
M_Edz/M_Rdz = 498948004/11169290923 = 0.045 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rc_LT1 = N_Ed/(Xiy*Aeff*fy/Gamma_M1)
Rb_LT1 = kyy*(M_Edy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kyz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rc_LT2 = N_Ed/(Xiz*Aeff*fy/Gamma_M1)
Rb_LT2 = kzy*(M_Edzy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kzz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rmax = MAX[Rcom+Rbend, MAX(Rc_LT1+Rb_LT1, Rc_LT2+Rb_LT2)] = 0.888 < 1.000 .... O.K

Shear Resistance

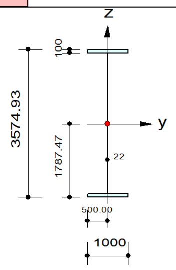
V_Edy/Vy_Rd = 0.026 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.189 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1674 (Memb:149, LCB: 4, POS: 911.8mm, Dir-Z)..................... O.K

	Company		Project Title	
	or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information



Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 150
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : Concio B dx (No:10)
Position I : BH 3574.93x1000x22/100 (Tapered Section)
Position J : BH 3533.17x1000x22/100
Member Length : 1823.50

Depth	3574.93	Web Thick	22.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	274249	Asz	78648.5
Qyb	9321345	Qzb	125000
Iyy	674399691071	Izz	16669661357
Ybar	500.000	Zbar	1787.47
Wely	377293673	Welz	33339323
ry	1568.15	rz	246.542

2. Member Forces

Axial Force Fxx = -1038663 (LCB: 9, POS:I)
Bending Moments My = 87630047440, Mz = -255413077
End Moments Myi = 87630047440, Myj = 84298817622 (for Lb)
Myi = 87630047440, Myj = 84298817622 (for Ly)
Mzi = -255413077, Mzj = 350026630 (for Lz)
Shear Forces Fyy = -990466 (LCB: 7-, POS:I)
Fzz = 2135593 (LCB: 7+, POS:J)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance
N_Ed/MIN[Nc_Rd, Nb_Rd] = 1038663/74187227 = 0.014 < 1.000 .... O.K

Bending Resistance
M_Edy/M_Rdy = 87630047440/121486646395 = 0.721 < 1.000 .... O.K
M_Edz/M_Rdz = 255413077/11168673109 = 0.023 < 1.000 .... O.K

Combined Resistance
Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rc_LT1 = N_Ed/(Xiy*Aeff*fy/Gamma_M1)
Rb_LT1 = kyy*(M_Edy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kyz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rc_LT2 = N_Ed/(Xiz*Aeff*fy/Gamma_M1)
Rb_LT2 = kzy*(M_Edzy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kzz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rmax = MAX[Rcom+Rbend, MAX(Rc_LT1+Rb_LT1, Rc_LT2+Rb_LT2)] = 0.834 < 1.000 .... O.K

Shear Resistance
V_Edy/Vy_Rd = 0.026 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.291 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1651 (Memb:150, LCB: 4, POS: 911.8mm, Dir-Z).................... O.K

Company		Project Title	
or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information

Design Code : Eurocode3-2:05

Unit System : N, mm

Member No : 151

Material : S355 (No:1)

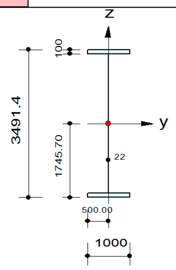
(Fy = 335.000, Es = 210000)

Section Name : Concio B dx (No:10)

Position I : BH 3491.4x1000x22/100 (Tapered Section)

Position J : BH 3449.64x1000x22/100

Member Length : 1823.50



Depth	3491.40	Web Thick	22.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	272411	Asz	76810.9
Qyb	9061905	Qzb	125000
Iyy	640618845251	Izz	16669587239
Ybar	500.000	Zbar	1745.70
Wely	366969151	Welz	33339174
ry	1533.51	rz	247.372

2. Member Forces

Axial Force Fxx = -916039 (LCB: 9, POS:I)

Bending Moments My = 80284305072, Mz = -182677063

End Moments Myi = 80284305072, Myj = 75813278910 (for Lb)

Myi = 80284305072, Myj = 75813278910 (for Ly)

Mzi = -182677063, Mzj = 163311497 (for Lz)

Shear Forces Fyy = -914334 (LCB: 7-, POS:I)

Fzz = 2721814 (LCB: 7+, POS:I)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50

Effective Length Factors Ky = 1.00, Kz = 1.00

Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/MIN[Nc_Rd, Nb_Rd] = 916039/74173872 = 0.012 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 80284305072/118501012676 = 0.677 < 1.000 .... O.K

M_Edz/M_Rdz = 182677063/11168623450 = 0.016 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd

Rc_LT1 = N_Ed/(Xiy*Aeff*fy/Gamma_M1)

Rb_LT1 = kyy*(M_Edy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kyz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)

Rc_LT2 = N_Ed/(Xiz*Aeff*fy/Gamma_M1)

Rb_LT2 = kzy*(M_Edzy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kzz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)

Rmax = MAX[Rcom+Rbend, MAX(Rc_LT1+Rb_LT1, Rc_LT2+Rb_LT2)] = 0.777 < 1.000 .... O.K

Shear Resistance

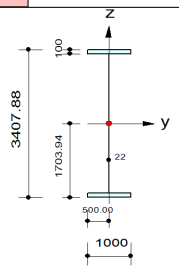
V_Edy/Vy_Rd = 0.024 < 1.000 .... O.K

V_Edz/Vz_Rd = 0.362 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1597 (Memb:151, LCB: 4, POS: 911.7mm, Dir-Z).................... O.K

1. Design Information



Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 152
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : Concio B dx (No:10)
Position I : BH 3407.88x1000x22/100 (Tapered Section)
Position J : BH 3366.11x1000x22/100
Member Length : 1823.50

Depth	3407.88	Web Thick	22.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	270573	Asz	74973.3
Qyb	8804209	Qzb	125000
Iyy	607788296337	Izz	16669513122
Ybar	500.000	Zbar	1703.94
Wely	356696220	Welz	33339026
ry	1498.77	rz	248.210

2. Member Forces

Axial Force Fxx = -685438 (LCB: 9, POS:I)
Bending Moments My = 70809837704, Mz = -256251226
End Moments Myi = 70809837704, Myj = 65170260562 (for Lb)
Myi = 70809837704, Myj = 65170260562 (for Ly)
Mzi = -256251226, Mzj = 138343305 (for Lz)
Shear Forces Fyy = -949552 (LCB: 7-, POS:I)
Fzz = 3382472 (LCB: 7+, POS:I)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/MIN[Nc_Rd, Nb_Rd] = 685438/74159821 = 0.009 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 70809837704/115514782257 = 0.613 < 1.000 .... O.K
M_Edz/M_Rdz = 256251226/11168573792 = 0.023 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rc_LT1 = N_Ed/(Xiy*Aeff*fy/Gamma_M1)
Rb_LT1 = kyy*(M_Edy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kyz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rc_LT2 = N_Ed/(Xiz*Aeff*fy/Gamma_M1)
Rb_LT2 = kzy*(M_Edzy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kzz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rmax = MAX[Rcom+Rbend, MAX(Rc_LT1+Rb_LT1, Rc_LT2+Rb_LT2)] = 0.710 < 1.000 .... O.K

Shear Resistance

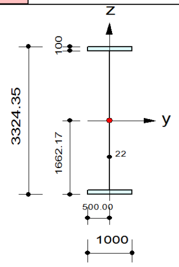
V_Edy/Vy_Rd = 0.025 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.426 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1483 (Memb:152, LCB: 4, POS: 911.8mm, Dir-Z).................... O.K

Company		Project Title	
or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information



Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 153
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : Concio B dx (No:10)
Position I : BH 3324.35x1000x22/100 (Tapered Section)
Position J : BH 3316x1000x22/100
Member Length : 364.500

Depth	3324.35	Web Thick	22.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	268736	Asz	73135.7
Qyb	8548258	Qzb	125000
Iyy	575901633857	Izz	16669439005
Ybar	500.000	Zbar	1662.17
Wely	346474915	Welz	33338878
ry	1463.90	rz	249.056

2. Member Forces

Axial Force Fxx = -569239 (LCB: 9, POS:I)
Bending Moments My = 58842836384, Mz = -317359914
End Moments Myi = 58842836384, Myj = 57497001786 (for Lb)
Myi = 58842836384, Myj = 57497001786 (for Ly)
Mzi = -317359914, Mzj = -223901825 (for Lz)
Shear Forces Fyy = -999753 (LCB: 7-, POS:I)
Fzz = 4041136 (LCB: 7+, POS:J)

3. Design Parameters

Unbraced Lengths Ly = 364.500, Lz = 364.500, Lb = 364.500
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance
N_Ed/MIN[Nc_Rd, Nb_Rd] = 569239/74145020 = 0.008 < 1.000 .... O.K

Bending Resistance
M_Edy/M_Rdy = 58842836384/112527956338 = 0.523 < 1.000 .... O.K
M_Edz/M_Rdz = 317359914/11168524133 = 0.028 < 1.000 .... O.K

Combined Resistance
Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rc_LT1 = N_Ed/(Xiy*Aeff*fy/Gamma_M1)
Rb_LT1 = kyy*(M_Edy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kyz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rc_LT2 = N_Ed/(Xiz*Aeff*fy/Gamma_M1)
Rb_LT2 = kzy*(M_Edzy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kzz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rmax = MAX[Rcom+Rbend, MAX(Rc_LT1+Rb_LT1, Rc_LT2+Rb_LT2)] = 0.615 < 1.000 .... O.K

Shear Resistance
V_Edy/Vy_Rd = 0.026 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.279 < 1.000 .... O.K

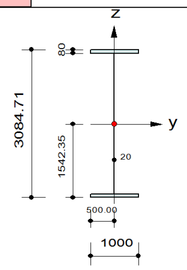
5. Deflection Checking Results

L/ 250.0 = 1.4580 > 0.0053 (Memb:153, LCB: 4, POS: 182.3mm, Dir-Z).................... O.K

Company		Project Title	
or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information

Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 154
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : Concio A dx (No:9)
Position I : BH 3084.71x1000x20/80 (Tapered Section)
Position J : BH 2956.22x1000x20/80
Member Length : 1823.50



Depth	3084.71	Web Thick	20.0000
Top F Width	1000.00	Top F Thick	80.0000
Bot.F Width	1000.00	Bot.F Thick	80.0000
Area	218494	Asz	61694.2
Qyb	7078661	Qzb	125000
Iyy	402912888146	Izz	13335283140
Ybar	500.000	Zbar	1542.35
Wely	261232264	Welz	26670566
ry	1357.96	rz	247.048

2. Member Forces

Axial Force Fxx = -114678 (LCB: 7+, POS:I)
Bending Moments My = 48011320352, Mz = 418155234
End Moments Myi = 48011320352, Myj = 39760630697 (for Lb)
Myi = 48011320352, Myj = 39760630697 (for Ly)
Mzi = 418155234, Mzj = 1005889547 (for Lz)
Shear Forces Fyy = -1068595 (LCB: 7-, POS:I)
Fzz = 4663234 (LCB: 7+, POS:I)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

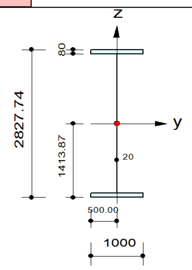
Axial Resistance
N_Ed/MIN[Nc_Rd, Nb_Rd] = 114678/59518531 = 0.002 < 1.000 .... O.K
Bending Resistance
M_Edy/M_Rdy = 48011320352/84469751106 = 0.568 < 1.000 .... O.K
M_Edz/M_Rdz = 418155234/8934639704 = 0.047 < 1.000 .... O.K
Combined Resistance
Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rc_LT1 = N_Ed/(Xiy*Aeff*fy/Gamma_M1)
Rb_LT1 = kyy*(M_Edy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kyz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rc_LT2 = N_Ed/(Xiz*Aeff*fy/Gamma_M1)
Rb_LT2 = kzy*(M_Edzy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kzz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rmax = MAX[Rcom+Rbend, MAX(Rc_LT1+Rb_LT1, Rc_LT2+Rb_LT2)] = 0.679 < 1.000 .... O.K
Shear Resistance
V_Edy/Vy_Rd = 0.035 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.724 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1406 (Memb:154, LCB: 4, POS: 911.7mm, Dir-Z).................... O.K

Company		**Project Title**	
or		**File Name**	C:\...\cavalcavia_rev4.mcb

1. Design Information



Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 155
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : Concio A dx (No:9)
Position I : BH 2827.74x1000x20/80 (Tapered Section)
Position J : BH 2699.25x1000x20/80
Member Length : 1823.50

Depth	2827.74	Web Thick	20.0000
Top F Width	1000.00	Top F Thick	80.0000
Bot.F Width	1000.00	Bot.F Thick	80.0000
Area	213355	Asz	56554.7
Qyb	6385076	Qzb	125000
Iyy	333730629086	Izz	13335111825
Ybar	500.000	Zbar	1413.87
Wely	236040803	Welz	26670224
ry	1250.68	rz	250.004

2. Member Forces

Axial Force Fxx = -172337 (LCB: 7+, POS:I)
Bending Moments My = 30697544358, Mz = 364979431
End Moments Myi = 30697544358, Myj = 21135926941 (for Lb)
Myi = 30697544358, Myj = 21135926941 (for Ly)
Mzi = 364979431, Mzj = 1061672240 (for Lz)
Shear Forces Fyy = -1146038 (LCB: 7-, POS:I)
Fzz = 5315492 (LCB: 7+, POS:I)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/MIN[Nc_Rd, Nb_Rd] = 172337/59474583 = 0.003 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 30697544358/77099667333 = 0.398 < 1.000 .... O.K

M_Edz/M_Rdz = 364979431/8934524922 = 0.041 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd

Rc_LT1 = N_Ed/(Xiy*Aeff*fy/Gamma_M1)

Rb_LT1 = kyy*(M_Edy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kyz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)

Rc_LT2 = N_Ed/(Xiz*Aeff*fy/Gamma_M1)

Rb_LT2 = kzy*(M_Edzy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kzz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)

Rmax = MAX[Rcom+Rbend, MAX(Rc_LT1+Rb_LT1, Rc_LT2+Rb_LT2)] = 0.486 < 1.000 .... O.K

Shear Resistance

V_Edy/Vy_Rd = 0.037 < 1.000 .... O.K

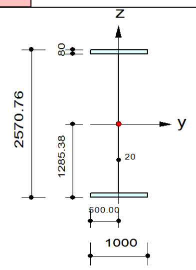
V_Edz/Vz_Rd = 0.763 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1005 (Memb:155, LCB: 4, POS: 911.8mm, Dir-Z).................... O.K

1. Design Information

Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 156
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : Concio A dx (No:9)
Position I : BH 2570.76x1000x20/80 (Tapered Section)
Position J : BH 2442.28x1000x20/80
Member Length : 1823.50



Depth	2570.76	Web Thick	20.0000
Top F Width	1000.00	Top F Thick	80.0000
Bot.F Width	1000.00	Bot.F Thick	80.0000
Area	208215	Asz	51415.3
Qyb	5708000	Qzb	125000
Iyy	271592835746	Izz	13334940509
Ybar	500.000	Zbar	1285.38
Wely	211293518	Welz	26669881
ry	1142.10	rz	253.069

2. Member Forces

Axial Force Fxx = -407961 (LCB: 7-, POS:I)
Bending Moments My = 6503028736, Mz = -1186880575
End Moments Myi = 6503028736, Myj = -560878062 (for Lb)
Myi = 6503028736, Myj = -560878062 (for Ly)
Mzi = -1186880575, Mzj = -201028996 (for Lz)
Shear Forces Fyy = -1153460 (LCB: 7-, POS:I)
Fzz = 6001290 (LCB: 7+, POS:J)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/MIN[Nc_Rd, Nb_Rd] = 407961/59421266 = 0.007 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 6503028736/69719330336 = 0.093 < 1.000 .... O.K
M_Edz/M_Rdz = 1186880575/8934410141 = 0.133 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rc_LT1 = N_Ed/(Xiy*Aeff*fy/Gamma_M1)
Rb_LT1 = kyy*(M_Edy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kyz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rc_LT2 = N_Ed/(Xiz*Aeff*fy/Gamma_M1)
Rb_LT2 = kzy*(M_Edzy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kzz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rmax = MAX[Rcom+Rbend, MAX(Rc_LT1+Rb_LT1, Rc_LT2+Rb_LT2)] = 0.201 < 1.000 .... O.K

Shear Resistance

V_Edy/Vy_Rd = 0.037 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.823 < 1.000 .... O.K

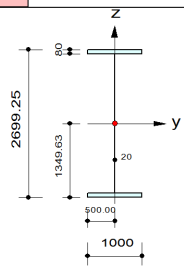
5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.0256 (Memb:156, LCB: 4, POS: 810.4mm, Dir-Z).................... O.K

Company		Project Title	
or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information

Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 157
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : concio A sx (No:7)
Position I : BH 2570.76x1000x20/80 (Tapered Section)
Position J : BH 2699.25x1000x20/80
Member Length : 1823.50



Depth	2699.25	Web Thick	20.0000
Top F Width	1000.00	Top F Thick	80.0000
Bot.F Width	1000.00	Bot.F Thick	80.0000
Area	210785	Asz	53985.0
Qyb	6044474	Qzb	125000
Iyy	301791780006	Izz	13335026167
Ybar	500.000	Zbar	1349.63
Wely	223611568	Welz	26670052
ry	1196.56	rz	251.523

2. Member Forces

Axial Force Fxx = 1653992 (LCB: 7+, POS:J)
Bending Moments My = 19921009663, Mz = 858810234
End Moments Myi = 10926497371, Myj = 19921009663 (for Lb)
Myi = 10926497371, Myj = 19921009663 (for Ly)
Mzi = 1040894050, Mzj = 858810234 (for Lz)
Shear Forces Fyy = 956923 (LCB: 7+, POS:I)
Fzz = -5626031 (LCB: 7-, POS:I)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance
N_Ed/Nt_Rd = 1653992/70612976 = 0.023 < 1.000 .... O.K
Bending Resistance
M_Edy/M_Rdy = 19921009663/73411302212 = 0.271 < 1.000 .... O.K
M_Edz/M_Rdz = 858810234/8934467532 = 0.096 < 1.000 .... O.K
Combined Resistance
Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rmax = MAX[RNRd, (Rcom+Rbend)] = 0.327 < 1.000 .... O.K
Shear Resistance
V_Edy/Vy_Rd = 0.031 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.765 < 1.000 .... O.K

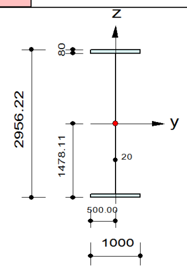
5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.0691 (Memb:157, LCB: 4, POS: 911.8mm, Dir-Z).................... O.K

Company		Project Title	
or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information

Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 158
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : concio A sx (No:7)
Position I : BH 2827.74x1000x20/80 (Tapered Section)
Position J : BH 2956.22x1000x20/80
Member Length : 1823.50



Depth	2956.22	Web Thick	20.0000
Top F Width	1000.00	Top F Thick	80.0000
Bot.F Width	1000.00	Bot.F Thick	80.0000
Area	215924	Asz	59124.5
Qyb	6729805	Qzb	125000
Iyy	367430594595	Izz	13335197482
Ybar	500.000	Zbar	1478.11
Wely	248581076	Welz	26670395
ry	1304.48	rz	248.513

2. Member Forces

Axial Force Fxx = 1526958 (LCB: 7+, POS:J)
Bending Moments My = 37633349323, Mz = 885827572
End Moments Myi = 28806731285, Myj = 37633349323 (for Lb)
Myi = 28806731285, Myj = 37633349323 (for Ly)
Mzi = 1058180542, Mzj = 885827572 (for Lz)
Shear Forces Fyy = 968120 (LCB: 7+, POS:I)
Fzz = -4949016 (LCB: 7-, POS:J)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance
N_Ed/Nt_Rd = 1526958/72334697 = 0.021 < 1.000 .... O.K
Bending Resistance
M_Edy/M_Rdy = 37633349323/80786800463 = 0.466 < 1.000 .... O.K
M_Edz/M_Rdz = 885827572/8934582313 = 0.099 < 1.000 .... O.K
Combined Resistance
Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rmax = MAX[RNRd, (Rcom+Rbend)] = 0.476 < 1.000 .... O.K
Shear Resistance
V_Edy/Vy_Rd = 0.031 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.685 < 1.000 .... O.K

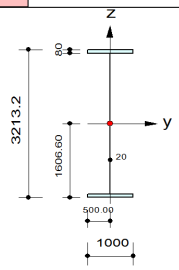
5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1185 (Memb:158, LCB: 4, POS: 911.8mm, Dir-Z).................... O.K

Company		Project Title	
or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information

Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 159
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : concio A sx (No:7)
Position I : BH 3084.71x1000x20/80 (Tapered Section)
Position J : BH 3213.2x1000x20/80
Member Length : 1823.50



Depth	3213.20	Web Thick	20.0000
Top F Width	1000.00	Top F Thick	80.0000
Bot.F Width	1000.00	Bot.F Thick	80.0000
Area	221064	Asz	64263.9
Qyb	7431644	Qzb	125000
Iyy	440198721350	Izz	13335368798
Ybar	500.000	Zbar	1606.60
Wely	273994264	Welz	26670738
ry	1411.12	rz	245.609

2. Member Forces

Axial Force Fxx = 1381126 (LCB: 7+, POS:J)
Bending Moments My = 53088802747, Mz = 907959825
End Moments Myi = 45504033243, Myj = 53088802747 (for Lb)
Myi = 45504033243, Myj = 53088802747 (for Ly)
Mzi = 1052280762, Mzj = 907959825 (for Lz)
Shear Forces Fyy = 967787 (LCB: 7+, POS:I)
Fzz = -4319857 (LCB: 7-, POS:J)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance
N_Ed/Nt_Rd = 1381126/74056417 = 0.019 < 1.000 .... O.K
Bending Resistance
M_Edy/M_Rdy = 53088802747/88157332511 = 0.602 < 1.000 .... O.K
M_Edz/M_Rdz = 907959825/8934697094 = 0.102 < 1.000 .... O.K
Combined Resistance
Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rmax = MAX[RNRd, (Rcom+Rbend)] = 0.722 < 1.000 .... O.K
Shear Resistance
V_Edy/Vy_Rd = 0.031 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.612 < 1.000 .... O.K

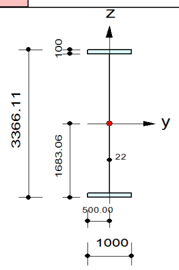
5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1430 (Memb:159, LCB: 4, POS: 911.7mm, Dir-Z)..................... O.K

Company		**Project Title**	
or		**File Name**	C:\...\cavalcavia_rev4.mcb

1. Design Information

Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 160
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : concio B sx (No:8)
Position I : BH 3324.35x1000x22/100 (Tapered Section)
Position J : BH 3366.11x1000x22/100
Member Length : 1823.50



Depth	3366.11	Web Thick	22.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	269654	Asz	74054.5
Qyb	8676016	Qzb	125000
Iyy	591727379947	Izz	16669476064
Ybar	500.000	Zbar	1683.06
Wely	351579112	Welz	33338952
ry	1481.35	rz	248.632

2. Member Forces

Axial Force Fxx = 1316246 (LCB: 7+, POS:J)
Bending Moments My = 66075137899, Mz = 994761664
End Moments Myi = 59719133733, Myj = 66075137899 (for Lb)
Myi = 59719133733, Myj = 66075137899 (for Ly)
Mzi = 1049284555, Mzj = 994761664 (for Lz)
Shear Forces Fyy = 990051 (LCB: 7+, POS:I)
Fzz = -3762179 (LCB: 7-, POS:I)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

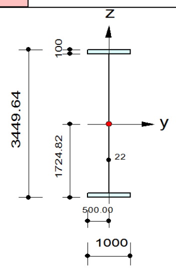
Axial Resistance
N_Ed/Nt_Rd = 1316246/90334247 = 0.015 < 1.000 .... O.K
Bending Resistance
M_Edy/M_Rdy = 66075137899/114021443583 = 0.579 < 1.000 .... O.K
M_Edz/M_Rdz = 994761664/11168548963 = 0.089 < 1.000 .... O.K
Combined Resistance
Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rmax = MAX[RNRd, (Rcom+Rbend)] = 0.683 < 1.000 .... O.K
Shear Resistance
V_Edy/Vy_Rd = 0.026 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.395 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1305 (Memb:160, LCB: 4, POS: 911.7mm, Dir-Z).................... O.K

1. Design Information

Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 161
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : concio B sx (No:8)
Position I : BH 3407.88x1000x22/100 (Tapered Section)
Position J : BH 3449.64x1000x22/100
Member Length : 1823.50



Depth	3449.64	Web Thick	22.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	271492	Asz	75892.1
Qyb	8932839	Qzb	125000
Iyy	624085184335	Izz	16669550181
Ybar	500.000	Zbar	1724.82
Wely	361826235	Welz	33339100
ry	1516.15	rz	247.790

2. Member Forces

Axial Force Fxx = 1170673 (LCB: 7+, POS:J)
Bending Moments My = 76517161282, Mz = 912416018
End Moments Myi = 71461658832, Myj = 76517161282 (for Lb)
Myi = 71461658832, Myj = 76517161282 (for Ly)
Mzi = 1063407476, Mzj = 912416018 (for Lz)
Shear Forces Fyy = 1014759 (LCB: 7+, POS:I)
Fzz = -3131138 (LCB: 7-, POS:I)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance
N_Ed/Nt_Rd = 1170673/90949849 = 0.013 < 1.000 .... O.K
Bending Resistance
M_Edy/M_Rdy = 76517161282/117007972024 = 0.654 < 1.000 .... O.K
M_Edz/M_Rdz = 912416018/11168598621 = 0.082 < 1.000 .... O.K
Combined Resistance
Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rmax = MAX[RNRd, (Rcom+Rbend)] = 0.749 < 1.000 .... O.K
Shear Resistance
V_Edy/Vy_Rd = 0.026 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.337 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1443 (Memb:161, LCB: 4, POS: 911.8mm, Dir-Z)..................... O.K

Company		Project Title	
or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information

Design Code : Eurocode3-2:05

Unit System : N, mm

Member No : 162

Material : S355 (No:1)

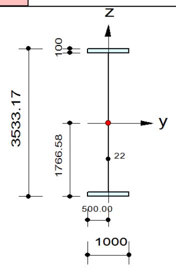
(Fy = 335.000, Es = 210000)

Section Name : concio B sx (No:8)

Position I : BH 3491.4x1000x22/100 (Tapered Section)

Position J : BH 3533.17x1000x22/100

Member Length : 1823.50



Depth	3533.17	Web Thick	22.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	273330	Asz	77729.7
Qyb	9191407	Qzb	125000
Iyy	657390080394	Izz	16669624298
Ybar	500.000	Zbar	1766.58
Wely	372124965	Welz	33339249
ry	1550.84	rz	246.956

2. Member Forces

Axial Force Fxx = 925707 (LCB: 7+, POS:J)

Bending Moments My = 84094151831, Mz = 889452673

End Moments Myi = 80366365977, Myj = 84094151831 (for Lb)

Myi = 80366365977, Myj = 84094151831 (for Ly)

Mzi = 1012878591, Mzj = 889452673 (for Lz)

Shear Forces Fyy = 992382 (LCB: 7+, POS:I)

Fzz = -2501564 (LCB: 7-, POS:I)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50

Effective Length Factors Ky = 1.00, Kz = 1.00

Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/Nt_Rd = 925707/91565451 = 0.010 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 84094151831/119989861358 = 0.701 < 1.000 .... O.K

M_Edz/M_Rdz = 889452673/11168648280 = 0.080 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd

Rmax = MAX[RNRd, (Rcom+Rbend)] = 0.791 < 1.000 .... O.K

Shear Resistance

V_Edy/Vy_Rd = 0.026 < 1.000 .... O.K

V_Edz/Vz_Rd = 0.274 < 1.000 .... O.K

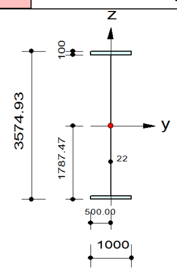
5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1515 (Memb:162, LCB: 4, POS: 911.8mm, Dir-Z)..................... O.K

Company		Project Title	
or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information

Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 163
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : concio B sx (No:8)
Position I : BH 3574.93x1000x22/100 (Tapered Section)
Position J : BH 3600x1000x22/100
Member Length : 1094.50



Depth	3574.93	Web Thick	22.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	274249	Asz	78648.5
Qyb	9321345	Qzb	125000
Iyy	674399691071	Izz	16669661357
Ybar	500.000	Zbar	1787.47
Wely	377293673	Welz	33339323
ry	1568.15	rz	246.542

2. Member Forces

Axial Force Fxx = 782821 (LCB: 7+, POS:I)
Bending Moments My = 86853363092, Mz = 928548102
End Moments Myi = 86853363092, Myj = 88155050178 (for Lb)
Myi = 86853363092, Myj = 88155050178 (for Ly)
Mzi = 928548102, Mzj = 424792013 (for Lz)
Shear Forces Fyy = 898584 (LCB: 7+, POS:I)
Fzz = -1881357 (LCB: 7-, POS:I)

3. Design Parameters

Unbraced Lengths Ly = 1094.50, Lz = 1094.50, Lb = 1094.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance
N_Ed/Nt_Rd = 782821/91873252 = 0.009 < 1.000 .... O.K
Bending Resistance
M_Edy/M_Rdy = 86853363092/121486646395 = 0.715 < 1.000 .... O.K
M_Edz/M_Rdz = 928548102/11168673109 = 0.083 < 1.000 .... O.K
Combined Resistance
Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rmax = MAX[RNRd, (Rcom+Rbend)] = 0.807 < 1.000 .... O.K
Shear Resistance
V_Edy/Vy_Rd = 0.023 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.161 < 1.000 .... O.K

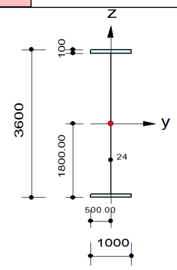
5. Deflection Checking Results

L/ 250.0 = 4.3780 > 0.0554 (Memb:163, LCB: 4, POS: 547.3mm, Dir-Z).................... O.K

Company		Project Title	
or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information

Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 164
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : concio C (No:6)
(Rolled : concio C).
Member Length : 1823.50



2. Member Forces

Axial Force Fxx = -226500 (LCB: 1, POS:J)
Bending Moments My = 86070438651, Mz = 814206860
End Moments Myi = 84390336200, Myj = 86070438651 (for Lb)
Myi = 84390336200, Myj = 86070438651 (for Ly)
Mzi = -282040651, Mzj = 814206860 (for Lz)
Shear Forces Fyy = 881690 (LCB: 7+, POS:I)
Fzz = -1278414 (LCB: 7-, POS:I)

Depth	3600.00	Web Thick	24.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	281600	Asz	86400.0
Qyb	8736667	Qzb	125000
Iyy	691274666667	Izz	16670583467
Ybar	500.000	Zbar	1800.00
Wely	384041481	Welz	33341167
ry	1566.78	rz	243.310

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/MIN[Nc_Rd, Nb_Rd] = 226500/75501496 = 0.003 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 86070438651/124151897436 = 0.693 < 1.000 .... O.K
M_Edz/M_Rdz = 814206860/11169290923 = 0.073 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rc_LT1 = N_Ed/(Xiy*Aeff*fy/Gamma_M1)
Rb_LT1 = kyy*(M_Edy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kyz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rc_LT2 = N_Ed/(Xiz*Aeff*fy/Gamma_M1)
Rb_LT2 = kzy*(M_Edzy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kzz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rmax = MAX[Rcom+Rbend, MAX(Rc_LT1+Rb_LT1, Rc_LT2+Rb_LT2)] = 0.846 < 1.000 .... O.K

Shear Resistance

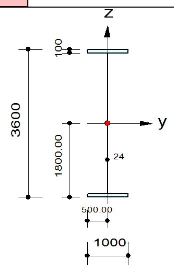
V_Edy/Vy_Rd = 0.023 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.128 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1574 (Memb:164, LCB: 4, POS: 911.8mm, Dir-Z).................... O.K

1. Design Information

Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 165
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : concio C (No:6)
(Rolled : concio C).
Member Length : 1824.00



2. Member Forces

Axial Force Fxx = 657929 (LCB: 7+, POS:I)
Bending Moments My = 92403932099, Mz = 1018521790
End Moments Myi = 92403932099, Myj = 92251503563 (for Lb)
Myi = 92403932099, Myj = 92251503563 (for Ly)
Mzi = 1018521790, Mzj = 944037980 (for Lz)
Shear Forces Fyy = 948171 (LCB: 7+, POS:I)
Fzz = 794654 (LCB: 7+, POS:J)

Depth	3600.00	Web Thick	24.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	281600	Asz	86400.0
Qyb	8736667	Qzb	125000
Iyy	691274666667	Izz	16670583467
Ybar	500.000	Zbar	1800.00
Wely	384041481	Welz	33341167
ry	1566.78	rz	243.310

3. Design Parameters

Unbraced Lengths Ly = 1824.00, Lz = 1824.00, Lb = 1824.00
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/Nt_Rd = 657929/94336000 = 0.007 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 92403932099/124151897436 = 0.744 < 1.000 .... O.K

M_Edz/M_Rdz = 1018521790/11169290923 = 0.091 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd

Rmax = MAX[RNRd, (Rcom+Rbend)] = 0.842 < 1.000 .... O.K

Shear Resistance

V_Edy/Vy_Rd = 0.025 < 1.000 .... O.K

V_Edz/Vz_Rd = 0.098 < 1.000 .... O.K

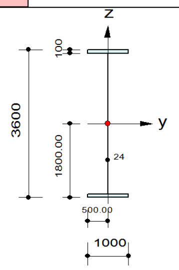
5. Deflection Checking Results

L/ 250.0 = 7.2960 > 0.1584 (Memb:165, LCB: 4, POS: 912.0mm, Dir-Z)..................... O.K

Company		Project Title	
Author		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information

Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 166
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : concio C (No:6)
(Rolled : concio C).
Member Length : 1823.50



2. Member Forces

Axial Force Fxx = 539769 (LCB: 7+, POS:I)
Bending Moments My = 91207583853, Mz = 1054455337
End Moments Myi = 91207583853, Myj = 89756349078 (for Lb)
Myi = 91207583853, Myj = 89756349078 (for Ly)
Mzi = 1054455337, Mzj = 838874291 (for Lz)
Shear Forces Fyy = 1006457 (LCB: 7+, POS:I)
Fzz = 1401521 (LCB: 7+, POS:J)

Depth	3600.00	Web Thick	24.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	281600	Asz	86400.0
Qyb	8736667	Qzb	125000
Iyy	691274666667	Izz	16670583467
Ybar	500.000	Zbar	1800.00
Wely	384041481	Welz	33341167
ry	1566.78	rz	243.310

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/Nt_Rd = 539769/94336000 = 0.006 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 91207583853/124151897436 = 0.735 < 1.000 .... O.K

M_Edz/M_Rdz = 1054455337/11169290923 = 0.094 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd

Rmax = MAX[RNRd, (Rcom+Rbend)] = 0.835 < 1.000 .... O.K

Shear Resistance

V_Edy/Vy_Rd = 0.026 < 1.000 .... O.K

V_Edz/Vz_Rd = 0.169 < 1.000 .... O.K

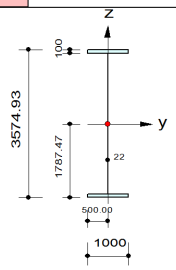
5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1548 (Memb:166, LCB: 4, POS: 911.8mm, Dir-Z)..................... O.K

	Company		Project Title	
	or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information

Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 167
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : Concio B dx (No:10)
Position I : BH 3574.93x1000x22/100 (Tapered Section)
Position J : BH 3533.17x1000x22/100
Member Length : 1823.50



Depth	3574.93	Web Thick	22.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	274249	Asz	78648.5
Qyb	9321345	Qzb	125000
Iyy	674399691071	Izz	16669661357
Ybar	500.000	Zbar	1787.47
Wely	377293673	Welz	33339323
ry	1568.15	rz	246.542

2. Member Forces

Axial Force Fxx = 330463 (LCB: 7+, POS:I)
Bending Moments My = 87179882171, Mz = 993639654
End Moments Myi = 87179882171, Myj = 84430937707 (for Lb)
Myi = 87179882171, Myj = 84430937707 (for Ly)
Mzi = 993639654, Mzj = 780507542 (for Lz)
Shear Forces Fyy = 987081 (LCB: 7+, POS:I)
Fzz = 2003574 (LCB: 7+, POS:J)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

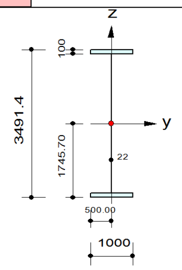
Axial Resistance
N_Ed/Nt_Rd = 330463/91873252 = 0.004 < 1.000 .... O.K
Bending Resistance
M_Edy/M_Rdy = 87179882171/121486646395 = 0.718 < 1.000 .... O.K
M_Edz/M_Rdz = 993639654/11168673109 = 0.089 < 1.000 .... O.K
Combined Resistance
Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rmax = MAX[RNRd, (Rcom+Rbend)] = 0.810 < 1.000 .... O.K
Shear Resistance
V_Edy/Vy_Rd = 0.026 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.266 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1522 (Memb:167, LCB: 4, POS: 911.8mm, Dir-Z)..................... O.K

Company		Project Title	
or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information



Design Code : Eurocode3-2:05

Unit System : N, mm

Member No : 168

Material : S355 (No:1)

(Fy = 335.000, Es = 210000)

Section Name : Concio B dx (No:10)

Position I : BH 3491.4x1000x22/100 (Tapered Section)

Position J : BH 3449.64x1000x22/100

Member Length : 1823.50

Depth	3491.40	Web Thick	22.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	272411	Asz	76810.9
Qyb	9061905	Qzb	125000
Iyy	640618845251	Izz	16669587239
Ybar	500.000	Zbar	1745.70
Wely	366969151	Welz	33339174
ry	1533.51	rz	247.372

2. Member Forces

Axial Force Fxx = 232805 (LCB: 7+, POS:I)

Bending Moments My = 80850733338, Mz = 954906281

End Moments Myi = 80850733338, Myj = 76761739134 (for Lb)

Myi = 80850733338, Myj = 76761739134 (for Ly)

Mzi = 954906281, Mzj = 854953055 (for Lz)

Shear Forces Fyy = 917891 (LCB: 7+, POS:I)

Fzz = 2574305 (LCB: 7+, POS:I)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50

Effective Length Factors Ky = 1.00, Kz = 1.00

Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/Nt_Rd = 232805/91257650 = 0.003 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 80850733338/118501012676 = 0.682 < 1.000 .... O.K

M_Edz/M_Rdz = 954906281/11168623450 = 0.085 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd

Rmax = MAX[RNRd, (Rcom+Rbend)] = 0.770 < 1.000 .... O.K

Shear Resistance

V_Edy/Vy_Rd = 0.024 < 1.000 .... O.K

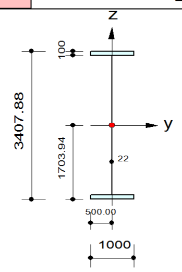
V_Edz/Vz_Rd = 0.335 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1469 (Memb:168, LCB: 4, POS: 911.7mm, Dir-Z).................... O.K

Company		Project Title	
or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information



Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 169
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : Concio B dx (No:10)
Position I : BH 3407.88x1000x22/100 (Tapered Section)
Position J : BH 3366.11x1000x22/100
Member Length : 1823.50

Depth	3407.88	Web Thick	22.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	270573	Asz	74973.3
Qyb	8804209	Qzb	125000
Iyy	607788296337	Izz	16669513122
Ybar	500.000	Zbar	1703.94
Wely	356696220	Welz	33339026
ry	1498.77	rz	248.210

2. Member Forces

Axial Force Fxx = 217598 (LCB: 7+, POS:I)
Bending Moments My = 72095462439, Mz = 1013740990
End Moments Myi = 72095462439, Myj = 66704010246 (for Lb)
Myi = 72095462439, Myj = 66704010246 (for Ly)
Mzi = 1013740990, Mzj = 922883041 (for Lz)
Shear Forces Fyy = 941990 (LCB: 7+, POS:I)
Fzz = 3212386 (LCB: 7+, POS:I)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/Nt_Rd = 217598/90642048 = 0.002 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 72095462439/115514782257 = 0.624 < 1.000 .... O.K
M_Edz/M_Rdz = 1013740990/11168573792 = 0.091 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rmax = MAX[RNRd, (Rcom+Rbend)] = 0.717 < 1.000 .... O.K

Shear Resistance

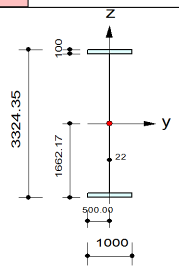
V_Edy/Vy_Rd = 0.024 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.397 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1362 (Memb:169, LCB: 4, POS: 911.8mm, Dir-Z)..................... O.K

	Company		Project Title	
	or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information



Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 170
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : Concio B dx (No:10)
Position I : BH 3324.35x1000x22/100 (Tapered Section)
Position J : BH 3316x1000x22/100
Member Length : 364.500

Depth	3324.35	Web Thick	22.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	268736	Asz	73135.7
Qyb	8548258	Qzb	125000
Iyy	575901633857	Izz	16669439005
Ybar	500.000	Zbar	1662.17
Wely	346474915	Welz	33338878
ry	1463.90	rz	249.056

2. Member Forces

Axial Force Fxx = 121726 (LCB: 7+, POS:I)
Bending Moments My = 60463629546, Mz = 1084111773
End Moments Myi = 60463629546, Myj = 59074114556 (for Lb)
Myi = 60463629546, Myj = 59074114556 (for Ly)
Mzi = 1084111773, Mzj = 758251067 (for Lz)
Shear Forces Fyy = 1000871 (LCB: 7+, POS:I)
Fzz = 3854980 (LCB: 7+, POS:J)

3. Design Parameters

Unbraced Lengths Ly = 364.500, Lz = 364.500, Lb = 364.500
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/Nt_Rd = 121726/90026446 = 0.001 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 60463629546/112527956338 = 0.537 < 1.000 .... O.K

M_Edz/M_Rdz = 1084111773/11168524133 = 0.097 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd

Rmax = MAX[RNRd, (Rcom+Rbend)] = 0.636 < 1.000 .... O.K

Shear Resistance

V_Edy/Vy_Rd = 0.026 < 1.000 .... O.K

V_Edz/Vz_Rd = 0.267 < 1.000 .... O.K

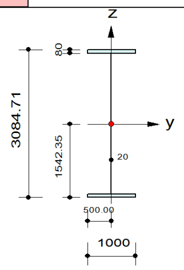
5. Deflection Checking Results

L/ 250.0 = 1.4580 > 0.0049 (Memb:170, LCB: 4, POS: 182.3mm, Dir-Z).................... O.K

	Company		Project Title	
	or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information

Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 171
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : Concio A dx (No:9)
Position I : BH 3084.71x1000x20/80 (Tapered Section)
Position J : BH 2956.22x1000x20/80
Member Length : 1823.50



Depth	3084.71	Web Thick	20.0000
Top F Width	1000.00	Top F Thick	80.0000
Bot.F Width	1000.00	Bot.F Thick	80.0000
Area	218494	Asz	61694.2
Qyb	7078661	Qzb	125000
Iyy	402912888146	Izz	13335283140
Ybar	500.000	Zbar	1542.35
Wely	261232264	Welz	26670566
ry	1357.96	rz	247.048

2. Member Forces

Axial Force Fxx = -44466 (LCB: 7+, POS:I)
Bending Moments My = 46286338073, Mz = 1128077176
End Moments Myi = 46286338073, Myj = 38347912113 (for Lb)
Myi = 46286338073, Myj = 38347912113 (for Ly)
Mzi = 1128077176, Mzj = 804543255 (for Lz)
Shear Forces Fyy = 1076435 (LCB: 7+, POS:I)
Fzz = 4460759 (LCB: 7+, POS:I)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/MIN[Nc_Rd, Nb_Rd] = 44466/59518531 = 0.001 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 46286338073/84469751106 = 0.548 < 1.000 .... O.K
M_Edz/M_Rdz = 1128077176/8934639704 = 0.126 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rc_LT1 = N_Ed/(Xiy*Aeff*fy/Gamma_M1)
Rb_LT1 = kyy*(M_Edy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kyz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rc_LT2 = N_Ed/(Xiz*Aeff*fy/Gamma_M1)
Rb_LT2 = kzy*(M_Edzy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kzz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rmax = MAX[Rcom+Rbend, MAX(Rc_LT1+Rb_LT1, Rc_LT2+Rb_LT2)] = 0.742 < 1.000 .... O.K

Shear Resistance

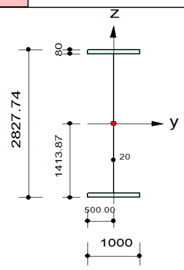
V_Edy/Vy_Rd = 0.035 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.683 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.1289 (Memb:171, LCB: 4, POS: 911.7mm, Dir-Z).................... O.K

Company		Project Title	
or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information



Design Code	: Eurocode3-2:05
Unit System	: N, mm
Member No	: 172
Material	: S355 (No:1)
	(Fy = 335.000, Es = 210000)
Section Name	: Concio A dx (No:9)
Position I	: BH 2827.74x1000x20/80 (Tapered Section)
Position J	: BH 2699.25x1000x20/80
Member Length	: 1823.50

Depth	2827.74	Web Thick	20.0000
Top F Width	1000.00	Top F Thick	80.0000
Bot.F Width	1000.00	Bot.F Thick	80.0000
Area	213355	Asz	56554.7
Qyb	6385076	Qzb	125000
Iyy	333730629086	Izz	13335111825
Ybar	500.000	Zbar	1413.87
Wely	236040803	Welz	26670224
ry	1250.68	rz	250.004

2. Member Forces

Axial Force	Fxx = -134976 (LCB: 7+, POS:I)
Bending Moments	My = 29575857408, Mz = 1206842677
End Moments	Myi = 29575857408, Myj = 20382780921 (for Lb)
	Myi = 29575857408, Myj = 20382780921 (for Ly)
	Mzi = 1206842677, Mzj = 687363938 (for Lz)
Shear Forces	Fyy = 1154238 (LCB: 7+, POS:I)
	Fzz = 5093515 (LCB: 7+, POS:I)

3. Design Parameters

Unbraced Lengths	Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors	Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors	Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/MIN[Nc_Rd, Nb_Rd] = 134976/59474583 = 0.002 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 29575857408/77099667333 = 0.384 < 1.000 .... O.K

M_Edz/M_Rdz = 1206842677/8934524922 = 0.135 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd

Rc_LT1 = N_Ed/(Xiy*Aeff*fy/Gamma_M1)

Rb_LT1 = kyy*(M_Edy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kyz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)

Rc_LT2 = N_Ed/(Xiz*Aeff*fy/Gamma_M1)

Rb_LT2 = kzy*(M_Edzy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kzz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)

Rmax = MAX[Rcom+Rbend, MAX(Rc_LT1+Rb_LT1, Rc_LT2+Rb_LT2)] = 0.573 < 1.000 .... O.K

Shear Resistance

V_Edy/Vy_Rd = 0.037 < 1.000 .... O.K

V_Edz/Vz_Rd = 0.727 < 1.000 .... O.K

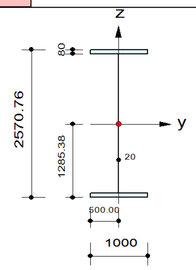
5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.0923 (Memb:172, LCB: 4, POS: 911.8mm, Dir-Z).................... O.K

Company		**Project Title**	
or		**File Name**	C:\...\cavalcavia_rev4.mcb

1. Design Information

Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 173
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : Concio A dx (No:9)
Position I : BH 2570.76x1000x20/80 (Tapered Section)
Position J : BH 2442.28x1000x20/80
Member Length : 1823.50



Depth	2570.76	Web Thick	20.0000
Top F Width	1000.00	Top F Thick	80.0000
Bot.F Width	1000.00	Bot.F Thick	80.0000
Area	208215	Asz	51415.3
Qyb	5708000	Qzb	125000
Iyy	271592835746	Izz	13334940509
Ybar	500.000	Zbar	1285.38
Wely	211293518	Welz	26669881
ry	1142.10	rz	253.069

2. Member Forces

Axial Force Fxx = -204900 (LCB: 7+, POS:I)
Bending Moments My = 10259796453, Mz = 1260101125
End Moments Myi = 10259796453, Myj = -11547446 (for Lb)
Myi = 10259796453, Myj = -11547446 (for Ly)
Mzi = 1260101125, Mzj = 165086134 (for Lz)
Shear Forces Fyy = 1160255 (LCB: 7+, POS:I)
Fzz = 5765169 (LCB: 7+, POS:J)

3. Design Parameters

Unbraced Lengths Ly = 1823.50, Lz = 1823.50, Lb = 1823.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance
N_Ed/MIN[Nc_Rd, Nb_Rd] = 204900/59421266 = 0.003 < 1.000 .... O.K

Bending Resistance
M_Edy/M_Rdy = 10259796453/69719330336 = 0.147 < 1.000 .... O.K
M_Edz/M_Rdz = 1260101125/8934410141 = 0.141 < 1.000 .... O.K

Combined Resistance
Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rc_LT1 = N_Ed/(Xiy*Aeff*fy/Gamma_M1)
Rb_LT1 = kyy*(M_Edy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kyz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rc_LT2 = N_Ed/(Xiz*Aeff*fy/Gamma_M1)
Rb_LT2 = kzy*(M_Edzy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kzz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rmax = MAX[Rcom+Rbend, MAX(Rc_LT1+Rb_LT1, Rc_LT2+Rb_LT2)] = 0.321 < 1.000 .... O.K

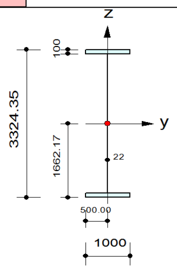
Shear Resistance
V_Edy/Vy_Rd = 0.037 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.790 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 7.2940 > 0.0239 (Memb:173, LCB: 4, POS: 810.4mm, Dir-Z).................... O.K

Company		Project Title	
or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information



Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 191
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : concio B sx (No:8)
Position I : BH 3316x1000x22/100 (Tapered Section)
Position J : BH 3324.35x1000x22/100
Member Length : 364.500

Depth	3324.35	Web Thick	22.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	268736	Asz	73135.7
Qyb	8548258	Qzb	125000
Iyy	575901633857	Izz	16669439005
Ybar	500.000	Zbar	1662.17
Wely	346474915	Welz	33338878
ry	1463.90	rz	249.056

2. Member Forces

Axial Force Fxx = -1553386 (LCB: 10, POS:J)
Bending Moments My = 58593132798, Mz = 349142
End Moments Myi = 57210683297, Myj = 58593132798 (for Lb)
Myi = 57210683297, Myj = 58593132798 (for Ly)
Mzi = -34483705, Mzj = 349142 (for Lz)
Shear Forces Fyy = 999421 (LCB: 7+, POS:I)
Fzz = -4044786 (LCB: 7-, POS:I)

3. Design Parameters

Unbraced Lengths Ly = 364.500, Lz = 364.500, Lb = 364.500
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance
N_Ed/MIN[Nc_Rd, Nb_Rd] = 1553386/74145020 = 0.021 < 1.000 .... O.K
Bending Resistance
M_Edy/M_Rdy = 58593132798/112527956338 = 0.521 < 1.000 .... O.K
M_Edz/M_Rdz = 349142/11168524133 = 0.000 < 1.000 .... O.K
Combined Resistance
Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rc_LT1 = N_Ed/(Xiy*Aeff*fy/Gamma_M1)
Rb_LT1 = kyy*(M_Edy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kyz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rc_LT2 = N_Ed/(Xiz*Aeff*fy/Gamma_M1)
Rb_LT2 = kzy*(M_Edzy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kzz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rmax = MAX[Rcom+Rbend, MAX(Rc_LT1+Rb_LT1, Rc_LT2+Rb_LT2)] = 0.596 < 1.000 .... O.K
Shear Resistance
V_Edy/Vy_Rd = 0.026 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.280 < 1.000 .... O.K

5. Deflection Checking Results

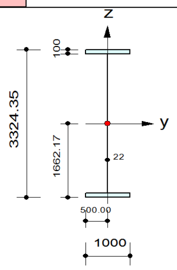
L/ 250.0 = 1.4580 > 0.0052 (Memb:191, LCB: 4, POS: 182.3mm, Dir-Z).................... O.K

MIDAS/Civil Steel Checking Result

Company		Project Title	
or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information

Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 192
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : concio B sx (No:8)
Position I : BH 3316x1000x22/100 (Tapered Section)
Position J : BH 3324.35x1000x22/100
Member Length : 364.500



Depth	3324.35	Web Thick	22.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	268736	Asz	73135.7
Qyb	8548258	Qzb	125000
Iyy	575901633857	Izz	16669439005
Ybar	500.000	Zbar	1662.17
Wely	346474915	Welz	33338878
ry	1463.90	rz	249.056

2. Member Forces

Axial Force Fxx = 1347741 (LCB: 7+, POS:J)
Bending Moments My = 59688271061, Mz = 1146870524
End Moments Myi = 58297740378, Myj = 59688271061 (for Lb)
Myi = 58297740378, Myj = 59688271061 (for Ly)
Mzi = 780641387, Mzj = 1146870524 (for Lz)
Shear Forces Fyy = -1013669 (LCB: 7-, POS:I)
Fzz = -3857868 (LCB: 7-, POS:I)

3. Design Parameters

Unbraced Lengths Ly = 364.500, Lz = 364.500, Lb = 364.500
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance
N_Ed/Nt_Rd = 1347741/90026446 = 0.015 < 1.000 .... O.K
Bending Resistance
M_Edy/M_Rdy = 59688271061/112527956338 = 0.530 < 1.000 .... O.K
M_Edz/M_Rdz = 1146870524/11168524133 = 0.103 < 1.000 .... O.K
Combined Resistance
Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rmax = MAX[RNRd, (Rcom+Rbend)] = 0.648 < 1.000 .... O.K
Shear Resistance
V_Edy/Vy_Rd = 0.026 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.267 < 1.000 .... O.K

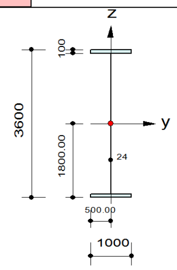
5. Deflection Checking Results

L/ 250.0 = 1.4580 > 0.0050 (Memb:192, LCB: 4, POS: 182.3mm, Dir-Z).................... O.K

Company		**Project Title**	
or		**File Name**	C:\...\cavalcavia_rev4.mcb

1. Design Information

Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 193
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : concio C (No:6)
(Rolled : concio C).
Member Length : 729.000



2. Member Forces

Axial Force Fxx = -1448895 (LCB: 10, POS:J)
Bending Moments My = 91917562007, Mz = -247768183
End Moments Myi = 90855017275, Myj = 91917562007 (for Lb)
Myi = 90855017275, Myj = 91917562007 (for Ly)
Mzi = -233977026, Mzj = -247768183 (for Lz)
Shear Forces Fyy = -931025 (LCB: 7-, POS:I)
Fzz = -1684326 (LCB: 9, POS:J)

Depth	3600.00	Web Thick	24.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	281600	Asz	86400.0
Qyb	8736667	Qzb	125000
Iyy	691274666667	Izz	16670583467
Ybar	500.000	Zbar	1800.00
Wely	384041481	Welz	33341167
ry	1566.78	rz	243.310

3. Design Parameters

Unbraced Lengths Ly = 729.000, Lz = 729.000, Lb = 729.000
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/MIN[Nc_Rd, Nb_Rd] = 1448895/75501496 = 0.019 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 91917562007/124151897436 = 0.740 < 1.000 .... O.K
M_Edz/M_Rdz = 247768183/11169290923 = 0.022 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rc_LT1 = N_Ed/(Xiy*Aeff*fy/Gamma_M1)
Rb_LT1 = kyy*(M_Edy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kyz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rc_LT2 = N_Ed/(Xiz*Aeff*fy/Gamma_M1)
Rb_LT2 = kzy*(M_Edzy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kzz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rmax = MAX[Rcom+Rbend, MAX(Rc_LT1+Rb_LT1, Rc_LT2+Rb_LT2)] = 0.860 < 1.000 .... O.K

Shear Resistance

V_Edy/Vy_Rd = 0.024 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.148 < 1.000 .... O.K

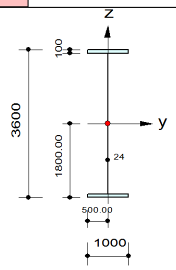
5. Deflection Checking Results

L/ 250.0 = 2.9160 > 0.0263 (Memb:193, LCB: 4, POS: 364.5mm, Dir-Z).................... O.K

Company		Project Title	
or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information

Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 194
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : concio C (No:6)
(Rolled : concio C).
Member Length : 729.000



2. Member Forces

Axial Force Fxx = 795751 (LCB: 7+, POS:J)
Bending Moments My = 89273633586, Mz = 953902149
End Moments Myi = 88155050179, Myj = 89273633586 (for Lb)
Myi = 88155050179, Myj = 89273633586 (for Ly)
Mzi = 425340872, Mzj = 953902149 (for Lz)
Shear Forces Fyy = 898584 (LCB: 7+, POS:I)
Fzz = -1858602 (LCB: 7-, POS:I)

Depth	3600.00	Web Thick	24.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	281600	Asz	86400.0
Qyb	8736667	Qzb	125000
Iyy	691274666667	Izz	16670583467
Ybar	500.000	Zbar	1800.00
Wely	384041481	Welz	33341167
ry	1566.78	rz	243.310

3. Design Parameters

Unbraced Lengths Ly = 729.000, Lz = 729.000, Lb = 729.000
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/Nt_Rd = 795751/94336000 = 0.008 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 89273633586/124151897436 = 0.719 < 1.000 .... O.K

M_Edz/M_Rdz = 953902149/11169290923 = 0.085 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd

Rmax = MAX[RNRd, (Rcom+Rbend)] = 0.813 < 1.000 .... O.K

Shear Resistance

V_Edy/Vy_Rd = 0.023 < 1.000 .... O.K

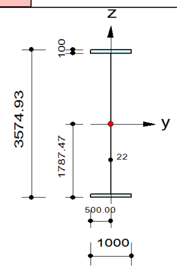
V_Edz/Vz_Rd = 0.116 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 2.9160 > 0.0245 (Memb:194, LCB: 4, POS: 364.5mm, Dir-Z).................... O.K

Company		Project Title	
or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information



Design Code	: Eurocode3-2:05
Unit System	: N, mm
Member No	: 195
Material	: S355 (No:1)
	(Fy = 335.000, Es = 210000)
Section Name	: Concio B dx (No:10)
Position I	: BH 3600x1000x22/100 (Tapered Section)
Position J	: BH 3574.93x1000x22/100
Member Length	: 1094.50

Depth	3574.93	Web Thick	22.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	274249	Asz	78648.5
Qyb	9321345	Qzb	125000
Iyy	674399691071	Izz	16669661357
Ybar	500.000	Zbar	1787.47
Wely	377293673	Welz	33339323
ry	1568.15	rz	246.542

2. Member Forces

Axial Force	Fxx = -1079588 (LCB: 9, POS:J)
Bending Moments	My = 87547449247, Mz = 341148682
End Moments	Myi = 89418277338, Myj = 87547449247 (for Lb)
	Myi = 89418277338, Myj = 87547449247 (for Ly)
	Mzi = 83918256, Mzj = 341148682 (for Lz)
Shear Forces	Fyy = 864704 (LCB: 7+, POS:I)
	Fzz = 1996379 (LCB: 7+, POS:J)

3. Design Parameters

Unbraced Lengths	Ly = 1094.50, Lz = 1094.50, Lb = 1094.50
Effective Length Factors	Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors	Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/MIN[Nc_Rd, Nb_Rd] = 1079588/74187227 = 0.015 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 87547449247/121486646395 = 0.721 < 1.000 .... O.K

M_Edz/M_Rdz = 341148682/11168673109 = 0.031 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd

Rc_LT1 = N_Ed/(Xiy*Aeff*fy/Gamma_M1)

Rb_LT1 = kyy*(M_Edy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kyz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)

Rc_LT2 = N_Ed/(Xiz*Aeff*fy/Gamma_M1)

Rb_LT2 = kzy*(M_Edzy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kzz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)

Rmax = MAX[Rcom+Rbend, MAX(Rc_LT1+Rb_LT1, Rc_LT2+Rb_LT2)] = 0.842 < 1.000 .... O.K

Shear Resistance

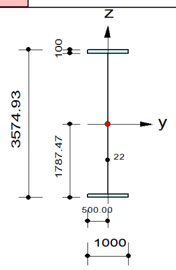
V_Edy/Vy_Rd = 0.022 < 1.000 .... O.K

V_Edz/Vz_Rd = 0.231 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 4.3780 > 0.0596 (Memb:195, LCB: 4, POS: 547.2mm, Dir-Z).................... O.K

1. Design Information



Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 196
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : Concio B dx (No:10)
Position I : BH 3600x1000x22/100 (Tapered Section)
Position J : BH 3574.93x1000x22/100
Member Length : 1094.50

Depth	3574.93	Web Thick	22.0000
Top F Width	1000.00	Top F Thick	100.000
Bot.F Width	1000.00	Bot.F Thick	100.000
Area	274249	Asz	78648.5
Qyb	9321345	Qzb	125000
Iyy	674399691071	Izz	16669661357
Ybar	500.000	Zbar	1787.47
Wely	377293673	Welz	33339323
ry	1568.15	rz	246.542

2. Member Forces

Axial Force Fxx = 383960 (LCB: 7+, POS:J)
Bending Moments My = 87144582076, Mz = 920233259
End Moments Myi = 88435972307, Myj = 87144582076 (for Lb)
Myi = 88435972307, Myj = 87144582076 (for Ly)
Mzi = 413514703, Mzj = 920233259 (for Lz)
Shear Forces Fyy = -855769 (LCB: 7-, POS:I)
Fzz = 1876618 (LCB: 7+, POS:J)

3. Design Parameters

Unbraced Lengths Ly = 1094.50, Lz = 1094.50, Lb = 1094.50
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance
N_Ed/Nt_Rd = 383960/91873252 = 0.004 < 1.000 .... O.K
Bending Resistance
M_Edy/M_Rdy = 87144582076/121486646395 = 0.717 < 1.000 .... O.K
M_Edz/M_Rdz = 920233259/11168673109 = 0.082 < 1.000 .... O.K
Combined Resistance
Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rmax = MAX[RNRd, (Rcom+Rbend)] = 0.804 < 1.000 .... O.K
Shear Resistance
V_Edy/Vy_Rd = 0.022 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.210 < 1.000 .... O.K

5. Deflection Checking Results

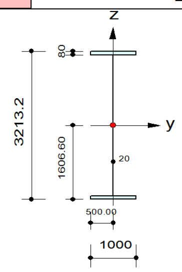
L/ 250.0 = 4.3780 > 0.0551 (Memb:196, LCB: 4, POS: 547.2mm, Dir-Z)..................... O.K

MIDAS/Civil **Steel Checking Result**

Company		Project Title	
or		File Name	C:\...\cavalcavia_rev4.mcb

1. Design Information

Design Code : Eurocode3-2:05
Unit System : N, mm
Member No : 197
Material : S355 (No:1)
(Fy = 335.000, Es = 210000)
Section Name : Concio A dx (No:9)
Position I : BH 3316x1000x20/80 (Tapered Section)
Position J : BH 3213.2x1000x20/80
Member Length : 1459.00



Depth	3213.20	Web Thick	20.0000
Top F Width	1000.00	Top F Thick	80.0000
Bot.F Width	1000.00	Bot.F Thick	80.0000
Area	221064	Asz	64263.9
Qyb	7431644	Qzb	125000
Iyy	440198721350	Izz	13335368798
Ybar	500.000	Zbar	1606.60
Wely	273994264	Welz	26670738
ry	1411.12	rz	245.609

2. Member Forces

Axial Force Fxx = -43806 (LCB: 7+, POS:J)
Bending Moments My = 55749279326, Mz = 901026560
End Moments Myi = 61217518405, Myj = 55749279326 (for Lb)
Myi = 61217518405, Myj = 55749279326 (for Ly)
Mzi = 305936658, Mzj = 901026560 (for Lz)
Shear Forces Fyy = -999753 (LCB: 7-, POS:I)
Fzz = 4027151 (LCB: 7+, POS:I)

3. Design Parameters

Unbraced Lengths Ly = 1459.00, Lz = 1459.00, Lb = 1459.00
Effective Length Factors Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

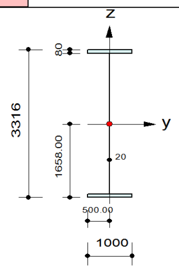
4. Checking Results

Axial Resistance
N_Ed/MIN[Nc_Rd, Nb_Rd] = 43806/59537731 = 0.001 < 1.000 .... O.K
Bending Resistance
M_Edy/M_Rdy = 55749279326/88157332511 = 0.632 < 1.000 .... O.K
M_Edz/M_Rdz = 901026560/8934697094 = 0.101 < 1.000 .... O.K
Combined Resistance
Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd
Rc_LT1 = N_Ed/(Xiy*Aeff*fy/Gamma_M1)
Rb_LT1 = kyy*(M_Edy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kyz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rc_LT2 = N_Ed/(Xiz*Aeff*fy/Gamma_M1)
Rb_LT2 = kzy*(M_Edzy+N_Ed*eNy)/(Xi_LT*Weffy*fy/Gamma_M1) + kzz*(M_Edz+N_Ed*eNz)/(Weffz*fy/Gamma_M1)
Rmax = MAX[Rcom+Rbend, MAX(Rc_LT1+Rb_LT1, Rc_LT2+Rb_LT2)] = 0.807 < 1.000 .... O.K
Shear Resistance
V_Edy/Vy_Rd = 0.032 < 1.000 .... O.K
V_Edz/Vz_Rd = 0.625 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 5.8360 > 0.1015 (Memb:197, LCB: 4, POS: 729.5mm, Dir-Z).................... O.K

1. Design Information



Design Code	: Eurocode3-2:05
Unit System	: N, mm
Member No	: 198
Material	: S355 (No:1)
	(Fy = 335.000, Es = 210000)
Section Name	: Concio A dx (No:9)
Position I	: BH 3316x1000x20/80 (Tapered Section)
Position J	: BH 3213.2x1000x20/80
Member Length	: 1459.00

Depth	3316.00	Web Thick	20.0000
Top F Width	1000.00	Top F Thick	80.0000
Bot.F Width	1000.00	Bot.F Thick	80.0000
Area	223120	Asz	66320.0
Qyb	7717042	Qzb	125000
Iyy	471344540693	Izz	13335437333
Ybar	500.000	Zbar	1658.00
Wely	284285006	Welz	26670875
ry	1453.45	rz	244.475

2. Member Forces

Axial Force	Fxx = 57163.9 (LCB: 7+, POS:I)
Bending Moments	My = 59074114556, Mz = 759892094
End Moments	Myi = 59074114556, Myj = 53794768978 (for Lb)
	Myi = 59074114556, Myj = 53794768978 (for Ly)
	Mzi = 759892094, Mzj = 866845695 (for Lz)
Shear Forces	Fyy = 1000871 (LCB: 7+, POS:I)
	Fzz = 3843547 (LCB: 7+, POS:I)

3. Design Parameters

Unbraced Lengths	Ly = 1459.00, Lz = 1459.00, Lb = 1459.00
Effective Length Factors	Ky = 1.00, Kz = 1.00
Equivalent Uniform Moment Factors	Cmy = 1.00, Cmz = 1.00, CmLT = 1.00

4. Checking Results

Axial Resistance

N_Ed/Nt_Rd = 57164/74745200 = 0.001 < 1.000 .... O.K

Bending Resistance

M_Edy/M_Rdy = 59074114556/91104560285 = 0.648 < 1.000 .... O.K

M_Edz/M_Rdz = 759892094/8934743013 = 0.085 < 1.000 .... O.K

Combined Resistance

Rcom = N_Ed/(Aeff*fy/Gamma_M0), Rbend = (M_Edy+N_Ed*eNy)/My_Rd + (M_Edz+N_Ed*eNz)/Mz_Rd

Rmax = MAX[RNRd, (Rcom+Rbend)] = 0.734 < 1.000 .... O.K

Shear Resistance

V_Edy/Vy_Rd = 0.032 < 1.000 .... O.K

V_Edz/Vz_Rd = 0.583 < 1.000 .... O.K

5. Deflection Checking Results

L/ 250.0 = 5.8360 > 0.0932 (Memb:198, LCB: 4, POS: 729.5mm, Dir-Z).................... O.K

Di seguito si riporta il dettaglio delle verifiche per la sezione maggiormente sollecitata del concio C, del concio B e del concio A delle travi principali.

6.6.2. Verifica di dettaglio Concio C

```
------------------------------------------------------------------------------------------
 MIDAS/Civil - Steel Code Checking[ Eurocode3-2:05 ]                    Version 8.5.6
=================================================================

     +=============================================================+
     | MIDAS(Modeling, Integrated Design & Analysis Software)    |
     | MIDAS/Civil - Design & checking system for windows        |
     +=============================================================+
     | Steel Member Applicable Code Checking                  |
     | Based On  AASHTO-LRFD12, AASHTO-LRFD02, AASHTO-LFD96,     |
     |           AASHTO-ASD96, AISC-LRFD2K, AISC-LRFD93,        |
     |           AISC-ASD89, Eurocode3-2:05, BS5950-90,         |
     |           IS:800-2007, IS:800-1984                       |
     |                                   (c)SINCE 1989  |
     +=============================================================+
     | MIDAS Information Technology Co.,Ltd.        (MIDAS IT)  |
     | MIDAS IT Design Development Team                        |
     +=============================================================+
     |           HomePage : www.MidasUser.com                  |
     +=============================================================+
     | MIDAS/Civil  Version 8.5.6                              |
     +=============================================================+

   *. DEFINITION OF LOAD COMBINATIONS WITH SCALING UP FACTORS.
---------------------------------------------------------------------------------------
    LCB  C    Loadcase Name(Factor) + Loadcase Name(Factor) + Loadcase Name(Factor)
---------------------------------------------------------------------------------------
     1  1    peso proprio( 1.350) + getto soletta( 1.350) +marciapiede destro( 1.350)
            +marciapiede sinistro( 1.350) +sicurvia destro( 1.350) +sicurvia sinistro( 1.350)
            +pavimentazione( 1.350) + MVmaxMVL1My47( 1.350) +Creep Secondary( 1.200)
            +Shrinkage Secondary( 1.200)
     2  1    peso proprio( 1.350) + getto soletta( 1.350) +marciapiede destro( 1.350)
            +marciapiede sinistro( 1.350) +sicurvia destro( 1.350) +sicurvia sinistro( 1.350)
            +pavimentazione( 1.350) +       termica( 1.500) +Creep Secondary( 1.200)
            +Shrinkage Secondary( 1.200)
     3  1    peso proprio( 1.350) + getto soletta( 1.350) +marciapiede destro( 1.350)
```

+marciapiede sinistro(1.350) +sicurvia destro(1.350) +sicurvia sinistro(1.350)
+pavimentazione(1.350) + termica(-1.500) +Creep Secondary(1.200)
+Shrinkage Secondary(1.200)
4 2 peso proprio(1.000) + getto soletta(1.000) +marciapiede destro(1.000)
+marciapiede sinistro(1.000) +sicurvia destro(1.000) +sicurvia sinistro(1.000)
+pavimentazione(1.000) + MVmaxMVL1Fz2(1.000) +Creep Secondary(1.000)
+Shrinkage Secondary(1.000)
5 2 peso proprio(1.000) + getto soletta(1.000) +marciapiede destro(1.000)
+marciapiede sinistro(1.000) +sicurvia destro(1.000) +sicurvia sinistro(1.000)
+pavimentazione(1.000) + termica(0.600) +Creep Secondary(1.000)
+Shrinkage Secondary(1.000)
6 2 peso proprio(1.000) + getto soletta(1.000) +marciapiede destro(1.000)
+marciapiede sinistro(1.000) +sicurvia destro(1.000) +sicurvia sinistro(1.000)
+pavimentazione(1.000) + termica(0.500) +Creep Secondary(1.000)
+Shrinkage Secondary(1.000)
7+ 1 peso proprio(1.350) + getto soletta(1.350) +marciapiede destro(1.350)
+marciapiede sinistro(1.350) +sicurvia destro(1.350) +sicurvia sinistro(1.350)
+pavimentazione(1.350) + MVL2(1.350) +Creep Secondary(1.200)
+Shrinkage Secondary(1.200)
7- 1 peso proprio(1.350) + getto soletta(1.350) +marciapiede destro(1.350)
+marciapiede sinistro(1.350) +sicurvia destro(1.350) +sicurvia sinistro(1.350)
+pavimentazione(1.350) + MVL2(1.350) +Creep Secondary(1.200)
+Shrinkage Secondary(1.200)
8 1 peso proprio(1.350) + getto soletta(1.350) +marciapiede destro(1.350)
+marciapiede sinistro(1.350) +sicurvia destro(1.350) +sicurvia sinistro(1.350)
+pavimentazione(1.350) + MVmaxMVL1Fz2(1.350) +Creep Secondary(1.200)
+Shrinkage Secondary(1.200)
9 1 peso proprio(1.350) + getto soletta(1.350) +marciapiede destro(1.350)
+marciapiede sinistro(1.350) +sicurvia destro(1.350) +sicurvia sinistro(1.350)
+pavimentazione(1.350) + MVmaxMVL1My10(1.350) +Creep Secondary(1.200)
+Shrinkage Secondary(1.200)
10 1 peso proprio(1.350) + getto soletta(1.350) +marciapiede destro(1.350)
+marciapiede sinistro(1.350) +sicurvia destro(1.350) +sicurvia sinistro(1.350)
+pavimentazione(1.350) +MVmaxMVL1My146(1.350) +Creep Secondary(1.200)
+Shrinkage Secondary(1.200)
11 1 peso proprio(1.350) + getto soletta(1.350) +marciapiede destro(1.350)
+marciapiede sinistro(1.350) +sicurvia destro(1.350) +sicurvia sinistro(1.350)
+pavimentazione(1.350) +MVmaxMVL1Fz140(1.350) +Creep Secondary(1.200)
+Shrinkage Secondary(1.200)
12 1 peso proprio(1.350) + getto soletta(1.350) +marciapiede destro(1.350)
+marciapiede sinistro(1.350) +sicurvia destro(1.350) +sicurvia sinistro(1.350)

+pavimentazione(1.350) + MVmaxMVL1My39(1.350) +Creep Secondary(1.200)
+Shrinkage Secondary(1.200)

----

*. PROJECT :
*. MEMBER NO = 10, ELEMENT TYPE = Beam
*. LOADCOMB NO = 9, MATERIAL NO = 1, SECTION NO = 6
*. UNIT SYSTEM : kN, cm

*. SECTION PROPERTIES : Designation = concio C
Shape = I - Section. (Built-up)
Depth = 360.000, Top F Width = 100.000, Bot.F Width = 100.000
Web Thick = 2.400, Top F Thick = 10.000, Bot.F Thick = 10.000

Area = 2.81600e+003, Avy = 2.00000e+003, Avz = 9.79200e+002
Ybar = 5.00000e+001, Zbar = 1.80000e+002, Qyb = 8.73667e+004, Qzb = 1.25000e+003
Wely = 3.84041e+005, Welz = 3.33412e+004, Wply = 4.19360e+005, Wplz = 5.04896e+004
Iyy = 6.91275e+007, Izz = 1.66706e+006, Iyz = 0.00000e+000
iy = 1.56678e+002, iz = 2.43310e+001
J = 6.82795e+004, Cwp = 5.10417e+010

*. DESIGN PARAMETERS FOR STRENGTH EVALUATION :
Ly = 1.82400e+002, Lz = 1.82400e+002, Lb = 1.82400e+002
Ky = 1.00000e+000, Kz = 1.00000e+000

*. MATERIAL PROPERTIES :
Fy = 3.35000e+001, Es = 2.10000e+004, MATERIAL NAME = S355

*. FORCES AND MOMENTS AT (J) POINT :
Axial Force Fxx =-1.14932e+003
Shear Forces Fyy = 4.28764e+002, Fzz =-5.42859e+002
Bending Moments My = 9.53249e+006, Mz =-5.54606e+004
End Moments Myi = 9.42845e+006, Myj = 9.53249e+006 (for Lb)
Myi = 9.42845e+006, Myj = 9.53249e+006 (for Ly)
Mzi = 2.27459e+004, Mzj =-5.54606e+004 (for Lz)

*. Sign conventions for stress and axial force.
- Stress : Compression positive.
- Axial force: Tension positive.

( ). Determine classification of compression outstand flanges.

[Eurocode3:05 Table 5.2 (Sheet 2 of 3), EN 1993-1-5]
-. e = SQRT(235/fy) = 0.84
-. b/t = BTR = 4.88
-. sigma1 = 24.238 kN/cm^2.
-. sigma2 = 23.166 kN/cm^2.
-. BTR < 9*e (Class 1 : Plastic).

==
[[[*]]] CLASSIFY RIGHT-TOP FLANGE OF SECTION (BTR).
==

( ). Determine classification of compression outstand flanges.
[Eurocode3:05 Table 5.2 (Sheet 2 of 3), EN 1993-1-5]
-. e = SQRT(235/fy) = 0.84
-. b/t = BTR = 4.88
-. sigma1 = 23.113 kN/cm^2.
-. sigma2 = 22.041 kN/cm^2.
-. BTR < 9*e (Class 1 : Plastic).

==
[[[*]]] CLASSIFY LEFT-BOTTOM FLANGE OF SECTION (BTR).
==

( ). Determine classification of tension outstand flanges.
-. Not Checking the Section Classification.

==
[[[*]]] CLASSIFY RIGHT-BOTTOM FLANGE OF SECTION (BTR).
==

( ). Determine classification of tension outstand flanges.
-. Not Checking the Section Classification.

==
[[[*]]] CLASSIFY WEB OF SECTION (HTR).
==

( ). Determine classification of bending and compression Internal Parts.
[Eurocode3:05 Table 5.2 (Sheet 1 of 3), EN 1993-1-5]
-. e = SQRT(235/fy) = 0.84
-. d/t = HTR = 141.67

-. sigma1 =   23.851 kN/cm^2.
-. sigma2 =   -23.034 kN/cm^2.
-. Psi   = [2*(Nsd/A)*(1/fy)]-1 = -0.976
-. RatPsi = 1 / (0.67 + 0.33*Psi) =   2.873
-. HTR > 42*e*RatPsi (Class 4 : Slender).

==
[[[*]]]   CALCULATE EFFECTIVE AREA.
==

( ). Calculate cross-section properties of left-top flange.
[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]
-. r   =   1.200 cm.
-. bc   =   48.800 cm.
-. beff = bc + r   =   50.000 cm.
-. Aeff = beff * tf =   500.000 cm^2.

( ). Calculate cross-section properties of right-top flange.
[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]
-. r   =   1.200 cm.
-. bc   =   48.800 cm.
-. beff = bc + r   =   50.000 cm.
-. Aeff = beff * tf =   500.000 cm^2.

( ). Calculate cross-section properties of left-bottom flange.
[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]
-. r   =   1.200 cm.
-. bc   =   48.800 cm.
-. beff = bc + r   =   50.000 cm.
-. Aeff = beff * tf =   500.000 cm^2.

( ). Calculate cross-section properties of right-bottom flange.
[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]
-. r   =   1.200 cm.
-. bc   =   48.800 cm.
-. beff = bc + r   =   50.000 cm.
-. Aeff = beff * tf =   500.000 cm^2.

( ). Calculate buckling factor of internal compression element.
[Eurocode3 Part 1-5 4.4, Table 4.1]
-. In case of Psi = 1.0

-. k_sigma = 4.0000

( ). Calculate effective cross-section properties of web of Class 4 (Internal element).
[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]
-. RatT   =141.6667
-. Lambda_p = RatT / [28.4*Eps*SQRT(k_sigma)] = 2.9779
-. Rho   = MIN[(Lambda_p-0.055*(3+psi)) / Lambda_p^2, 1.0] = 0.3110
-. sigma_max = MAX(sigma1, sigma2) =   0.408 kN/cm^2.
-. sigma_min = MIN(sigma1, sigma2) =   0.408 kN/cm^2.
-. r   =   0.000 cm.
-. Ar   =   0.000 cm^2.
-. dc   =   340.000 cm.
-. deff1 = 2*(Rho*dc) / [5 - sigma_min/sigma_max] + r =   52.870 cm.
-. Aeff1 = deff1 * tw + 2*Ar   =   126.888 cm^2.
-. zeff1 = deff1/2 + tf   =   36.435 cm.
-. deff2 = (Rho*dc) - deff1 + r   =   52.870 cm.
-. Aeff2 = deff2 * tw + 2*Ar   =   126.888 cm^2.
-. zeff2 = (h+2*r) - deff2/2 + tf =   323.565 cm.

==
[[[*]]]   CALCULATE EFFECTIVE SECTION MODULUS ABOUT MAJOR AXIS.
==

( ). Calculate cross-section properties of left-top flange.
[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]

-. r   =   1.200 cm.
-. bc   =   48.800 cm.
-. beff = bc + r   =   50.000 cm.
-. Aeff = beff * tf =   500.000 cm^2.
-. yeff = beff/2   =   25.000 cm.

( ). Calculate cross-section properties of right-top flange.
[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]
-. r   =   1.200 cm.
-. bc   =   48.800 cm.
-. beff = bc + r   =   50.000 cm.
-. Aeff = beff * tf =   500.000 cm^2.
-. yeff = beff/2   =   25.000 cm.

( ). Calculate cross-section properties of left-bottom flange.

[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]

-. r = 1.200 cm.

-. bc = 48.800 cm.

-. beff = bc + r = 50.000 cm.

-. Aeff = beff * tf = 500.000 cm^2.

-. yeff = beff/2 = 25.000 cm.

( ). Calculate cross-section properties of right-bottom flange.

[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]

-. r = 1.200 cm.

-. bc = 48.800 cm.

-. beff = bc + r = 50.000 cm.

-. Aeff = beff * tf = 500.000 cm^2.

-. yeff = beff/2 = 25.000 cm.

( ). Calculate buckling factor of internal compression element.

[Eurocode3 Part 1-5 4.4, Table 4.1]

-. In case of Psi = -1.0

-. k_sigma = 23.9000

( ). Calculate effective cross-section properties of web of Class 4 (Internal element).

[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]

-. RatT =141.6667

-. Lambda_p = RatT / [28.4*Eps*SQRT(k_sigma)] = 1.2183

-. Rho = MIN[(Lambda_p-0.055*(3+psi)) / Lambda_p^2, 1.0] = 0.7467

-. sigma_max = MAX(sigma1, sigma2) = 23.443 kN/cm^2.

-. sigma_min = MIN(sigma1, sigma2) = -23.443 kN/cm^2.

-. r = 0.000 cm.

-. Ar = 0.000 cm^2.

-. dc = (h*sigma_max) / (sigma_max-sigma_min) = 170.000 cm.

-. deff1 = 0.4*Rho*dc + r = 50.778 cm.

-. Aeff1 = deff1 * tw + 2*Ar = 121.866 cm^2.

-. zeff1 = (h+2*r) - deff1/2 + tf = 324.611 cm.

-. deff2 = 0.6*Rho*dc + (h-dc) + r = 246.166 cm.

-. Aeff2 = deff2 * tw + 2*Ar = 590.799 cm^2.

-. zeff2 = deff2/2 + tf = 133.083 cm.

==

[[[*]]] CALCULATE EFFECTIVE SECTION MODULUS ABOUT MINOR AXIS.

==

( ). Calculate cross-section properties of left-top flange.
[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]
-. r = 1.200 cm.
-. bc = 48.800 cm.
-. beff = bc + r = 50.000 cm.
-. Aeff = beff * tf = 500.000 cm^2.
-. yeff = beff/2 = 25.000 cm.

( ). Calculate cross-section properties of right-top flange.
[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]
-. r = 1.200 cm.
-. bc = 48.800 cm.
-. beff = bc + r = 50.000 cm.
-. Aeff = beff * tf = 500.000 cm^2.
-. yeff = beff/2 = 25.000 cm.

( ). Calculate cross-section properties of left-bottom flange.
[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]
-. r = 1.200 cm.
-. bc = 48.800 cm.
-. beff = bc + r = 50.000 cm.
-. Aeff = beff * tf = 500.000 cm^2.
-. yeff = beff/2 = 25.000 cm.

( ). Calculate cross-section properties of right-bottom flange.
[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]
-. r = 1.200 cm.
-. bc = 48.800 cm.
-. beff = bc + r = 50.000 cm.
-. Aeff = beff * tf = 500.000 cm^2.
-. yeff = beff/2 = 25.000 cm.

( ). Calculate effective cross-section properties of web of Class 4 (Internal element).
[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]
-. Rho = 1.0 (Only tensile stresses).
-. sigma_max = MAX(sigma1, sigma2) = 0.000 kN/cm^2.
-. sigma_min = MIN(sigma1, sigma2) = 0.000 kN/cm^2.
-. r = 0.000 cm.
-. Ar = 0.000 cm^2.
-. dc = 340.000 cm.
-. deff = dc + r = 340.000 cm.

-. Aeff = deff * tw + 4*Ar =   816.000 cm^2.
-. zeff = (h+2*r) - deff/2 =   180.000 cm.

==
[[[*]]]   EFFECTIVE SECTION PPOPERTIES.
==

( ). Calculated effective cross-section properties of Class4 cross-section.
-. Aeff =   2253.7760 cm^2. (for calculating axial resistance)
-. Aeffy =   2712.6652 cm^2.
-. Weffy =   370602.6789 cm^3.
-. Aeffz =   2816.0000 cm^2.
-. Weffz =   33341.1669 cm^3.
-. eNy   =   0.0000 cm.
-. eNz   =   0.0000 cm.

==
[[[*]]]   APPLIED FACTORS.
==

( ). Calculate equivalent uniform moment factors (Cmy,Cmz,CmLT).
[Eurocode3:05 Annex A. Table A.1, A.2]
-. Cmy,0   = 0.998
-. Cmz,0   = 0.704
-. Cmy (Default or User Defined Value) = 1.000
-. Cmz (Default or User Defined Value) = 1.000
-. CmLT (Default or User Defined Value) = 1.000

( ). Partial Factors (Gamma_Mi).
[Eurocode3:05 6.1]
-. Gamma_M0 = 1.00
-. Gamma_M1 = 1.10
-. Gamma_M2 = 1.25

==
[[[*]]]   CHECK AXIAL RESISTANCE.
==

( ). Check slenderness ratio of axial compression member (Kl/i).
[Eurocode3:05 6.3.1]
-. Kl/i =   7.5 <   200.0 ---> O.K.

( ). Calculate axial compressive resistance (Nc_Rd).
[Eurocode3:05 6.1, 6.2.4]
-. Nc_Rd = fy * Aeff / Gamma_M0 = 75501.50 kN.

( ). Check ratio of axial resistance (N_Ed/Nc_Rd).
```
   N_Ed          1149.32
-. -----  =  ---------------  =  0.015  <  1.000  --->  O.K.
   Nc_Rd         75501.50
```

( ). Calculate buckling resistance of compression member (Nb_Rdy, Nb_Rdz).
[Eurocode3:05 6.3.1.1, 6.3.1.2]
-. Beta_A = Aeff / Area = 0.800
-. Lambda1 = Pi * SQRT(Es/fy) = 78.657
-. Lambda_by = {(Ky*Ly/iy)/Lambda1} * SQRT(Beta_A) = 0.013
-. Ncry = Pi^2*Es*Iyy / (Ky*Ly)^2 = 430645599.31 kN.
-. Lambda_by < 0.2 or N_Ed/Ncry < 0.04 --> No need to check.

-. Lambda_bz = {(Kz*Lz/iz)/Lambda1} * SQRT(Beta_A) = 0.085
-. Ncrz = Pi^2*Es*Izz / (Kz*Lz)^2 = 10385326.92 kN.
-. Lambda_bz < 0.2 or N_Ed/Ncrz < 0.04 --> No need to check.

==
[[[*]]] CHECK SHEAR RESISTANCE.
==

( ). Calculate shear area.
[Eurocode3:05 6.2.6, EN1993-1-5:04 5.1 NOTE 2]
-. eta = 1.2 (Fy < 460 MPa.)
-. Avy = 2*B*tf = 2000.0000 cm^2.
-. Avz = eta*hw*tw = 979.2000 cm^2.

( ). Calculate plastic shear resistance in local-y direction (Vpl_Rdy).
[Eurocode3:05 6.1, 6.2.6]
-. Vpl_Rdy = [Avy*fy/SQRT(3)] / Gamma_M0 = 38682.47 kN.

( ). Check ratio of shear resistance (V_Edy/Vpl_Rdy).
(LCB = 7+, POS = J)
-. Applied shear force : V_Edy = 946.67 kN.
```
   V_Edy          946.67
-. -------  =  ---------------  =  0.024  <  1.000  --->  O.K.
```

```
        Vpl_Rdy          38682.47

   ( ). Calculate plastic shear resistance in local-z direction (Vpl_Rdz).
        [ Eurocode3:05  6.1, 6.2.6 ]
        -. Vpl_Rdz = [ Avz*fy/SQRT(3) ] / Gamma_M0 =      18938.94 kN.

   ( ). Shear Buckling Check.
        [ Eurocode3:05 6.2.6 ]
        -. HTR > 72*e/Eta   --->  Need to check!

   ( ). Calculate shear buckling resistance in local-z direction (Vbl_Rdz).
        [ Eurocode3:05  6.1, 6.2.6, EN 1993-1-5:2004 5.2 ]
        -. Eta      =  1.20
        -. Lambda_w = hw / (86.4*tw*e) =      1.9577
        -. Chi_w    = 0.83/Lambda_w    =  0.42
        -. Vbw_Rdz  = Chi_w*fy*hw*tw / [sqrt(3)*Gamma_M1] =       6082.99 kN.

        -. Af1     =     1000.0000 cm^2.
        -. Af2     =     1000.0000 cm^2.
        -. Mfk     = Af1*fy*(H-Zbar-tf/2) + Af2*fy*(Zbar-tf/2) =   11725000.00 kN-cm.
        -. rf      = 1-[Ned/{(Af1+Af2)*fy/Gamma_M0}]           =    0.9828(0<rf<1)
        -. Mf_Rd   = rf*Mfk/Gamma_M0                          =   11523869.58 kN-cm.
        -. In case of M_Ed < Mf_Rd
        -. a        = Ly =  182.4000 cm.
        -. bf       = min(B, 30*e*tf)                      =  100.0000 cm.
        -. c        = a*[ 0.25 + (1.6*bf*tf^2*fy)/(tw*hw^2*fy)]    =   56.1190 cm.
        -. Vbf_Rdz  = (bf*tf^2*fy)/(c*Gamma_M1)*[1-(M_Ed/Mf_Rd)^2] =       1713.49 kN.

        -. Vb_Rdz1 = Vw_Rdz + Vf_Rdz                  =       7796.49 kN.
        -. Vb_Rdz2 = Eta*fy*hw*tw / [sqrt(3)*Gamma_M1]   =      17217.21 kN.
        -. Vb_Rdz  = min[ Vbw_rdz1, Vbw_rdz2 ]          =       7796.49 kN.

   ( ). Check ratio of shear resistance (V_Edz/Vb_Rdz).
        ( LCB =   7+, POS =    J )
        -. Applied shear force : V_Edz   =        767.41 kN.
            V_Edz            767.41
        -. --------  =  ---------------  =  0.098  <  1.000  --->  O.K.
           Vb_Rdz           7796.49

================================================================================
 [[[*]]]   CHECK BENDING MOMENT RESISTANCE ABOUT MAJOR AXIS.
```

==

( ). Calculate local buckling resistance moment about major axis.
[Eurocode3:05 6.1, 6.2.5]
-. Weffy   =   370602.6789 cm^3.
-. Mc_Rdy   = Weffy * fy / Gamma_M0 =   12415189.74 kN-cm.

( ). Check ratio of moment resistance (M_Edy/Mc_Rdy).

```
     M_Edy        9532491.59
-. ------  =  ---------------  =  0.768  <  1.000  --->  O.K.
    Mc_Rdy       12415189.74
```

==
[[[*]]]   CHECK BENDING MOMENT RESISTANCE ABOUT MINOR AXIS.
==

( ). Calculate local buckling resistance moment about minor axis.
[Eurocode3:05 6.1, 6.2.5]
-. Weffz   =   33341.1669 cm^3.
-. Mc_Rdz   = Weffz * fy / Gamma_M0 =   1116929.09 kN-cm.

( ). Check ratio of moment resistance (M_Edz/Mc_Rdz).

```
    M_Edz           55460.63
-. ------  =  ---------------  =  0.050  <  1.000  --->  O.K.
    Mc_Rdz        1116929.09
```

==
[[[*]]]   CHECK LATERAL-TORSIONAL BUCKLING RESISTANCE.
==

( ). Calculate lateral-torsional buckling resistance (Mb_Rd).
[Eurocode3:05 6.1, 6.3.2]
-. Por   =   0.300
-. Gs   = Es / [2*(1+Por)] =   8076.923 kN/cm^2.
-. Ncr   = Pi^2*Es*Izz / Lu^2 =   10385326.92 kN.
-. psi   =   0.989
-. C1   =   1.285
-. Mcr   = C1 * Ncr * SQRT [(Cwp/Izz) + (Gs*Ixx)/Ncr] = 2337150131.05 kN-cm.

-. Lambda_LT_bar = SQRT [Weffy*fy / Mcr] =   0.073
-. Lambda_LT_bar0 =   0.200

-. Lambda_LT_bar = 0.073 < Lambda_LT_bar0 = 0.200

-. M_Ed/Mcr = 0.004 < Lambda_LT_bar0^2 = 0.040

If Lambda_LT_bar < Lambda_LT_bar0 or M_Ed/Mcr < Lambda_LT_bar0^2,

No allowance for lateral-torsional buckling necessary.

==

[[[*]]] CHECK INTERACTION OF COMBINED RESISTANCE.

==

( ). Calculate Major reduced design resistance of bending and shear.

[Eurocode3:05 6.2.8 (6.30)]

-. In case of V_Edz / Vpl_Rdz < 0.5

-. My_Rd = Mc_Rdy = 12415189.74 kN-cm.

( ). Calculate Minor reduced design resistance of bending and shear.

[Eurocode3:05 6.2.8 (6.30)]

-. In case of V_Edy / Vpl_Rdy < 0.5

-. Mz_Rd = Mc_Rdz = 1116929.09 kN-cm.

( ). Check interaction ratio of bending and axial force.

[Eurocode3:05 6.2.9.3 (6.44)] - Class4

```
                N_Ed          M_Edy + N_Ed*eNz     M_Edz + N_Ed*eNy
-. Rmax1  = ---------------- + ------------------ + ------------------
          Aeff*fy/Gamma_M0        My_Rd                Mz_Rd
        =  0.833  <  1.000  --->  O.K.
```

( ). Check interaction ratio of bending and axial compression member.

[Eurocode3:05 6.3.1, 6.2.9.3 (6.61, 6.62), Annex A]

-. N_Ed = -1149.32 kN.

-. M_Edy = 9532491.59 kN-cm.

-. M_Edz = -55460.63 kN-cm.

-. kyy = 1.000

-. kyz = 1.000

-. kzy = 1.000

-. kzz = 1.000

-. Xiy = 1.000

-. Xiz = 1.000

-. XiLT = 1.000

-. Aeff = 2253.7760 cm^2.

-. Weffy = 370602.6789 cm^3.

-. Weffz = 33341.1669 cm^3.
-. eNy = 0.0000 cm.
-. eNz = 0.0000 cm.
-. N_Rk = Aeff*fy = 75501.50 kN.
-. My_Rk = Weffy*fy = 12415189.74 kN-cm.
-. Mz_Rk = Weffz*fy = 1116929.09 kN-cm.
-. N_Ed*eNy = 0.00 kN-cm.
-. N_Ed*eNZ = 0.00 kN-cm.

```
                N_Ed                M_Edy + N_Ed*eNy          M_Edz + N_Ed*eNz
-. Rmax_LT1 = ----------------- + kyy * ------------------- + kyz * ----------------
           Xiy*N_Rk/Gamma_M1        XiLT*My_Rk/Gamma_M1         Mz_Rk/Gamma_M1
          =  0.916  <  1.000  --->  O.K.
                N_Ed                M_Edy + N_Ed*eNy          M_Edz + N_Ed*eNz
-. Rmax_LT2 = ----------------- + kzy * ------------------- + kzz * ----------------
           Xiz*N_Rk/Gamma_M1        XiLT*My_Rk/Gamma_M1         Mz_Rk/Gamma_M1
          =  0.916  <  1.000  --->  O.K.
```

-. Rmax = MAX[Rmax1, MAX(Rmax_LT1, Rmax_LT2)] = 0.916 < 1.000 ---> O.K.

==
[[[*]]] CHECK DEFLECTION.
==

( ). Compute Maximum Deflection.

-. LCB = 4
-. DAF = 1.000 (Deflection Amplification Factor).
-. Position = 91.200cm From i-end(Node 10).
-. Def = -0.017 * DAF = -0.017cm (Golbal Z)
-. Def_Lim = 0.730cm
Def < Def_Lim ---> O.K !

6.6.3. Verifica di dettaglio Concio B

```
------------------------------------------------------------------------------------------
 MIDAS/Civil - Steel Code Checking[ Eurocode3-2:05 ]                    Version 8.5.6
=====================================================================

   +===============================================================+
   | MIDAS(Modeling, Integrated Design & Analysis Software)    |
   | MIDAS/Civil - Design & checking system for windows        |
   +===============================================================+
   | Steel Member Applicable Code Checking                     |
   | Based On  AASHTO-LRFD12, AASHTO-LRFD02, AASHTO-LFD96,     |
   |           AASHTO-ASD96, AISC-LRFD2K, AISC-LRFD93,         |
   |           AISC-ASD89, Eurocode3-2:05, BS5950-90,          |
   |           IS:800-2007, IS:800-1984                        |
   |                                  (c)SINCE 1989  |
   +===============================================================+
   | MIDAS Information Technology Co.,Ltd.         (MIDAS IT)  |
   | MIDAS IT Design Development Team                          |
   +===============================================================+
   |           HomePage : www.MidasUser.com                    |
   +===============================================================+
   | MIDAS/Civil  Version 8.5.6                                |
   +===============================================================+

  *. DEFINITION OF LOAD COMBINATIONS WITH SCALING UP FACTORS.
-------------------------------------------------------------------------------------
   LCB  C    Loadcase Name(Factor) + Loadcase Name(Factor) + Loadcase Name(Factor)
-------------------------------------------------------------------------------------
     1  1    peso proprio( 1.350) + getto soletta( 1.350) +marciapiede destro( 1.350)
            +marciapiede sinistro( 1.350) +sicurvia destro( 1.350) +sicurvia sinistro( 1.350)
            +pavimentazione( 1.350) + MVmaxMVL1My47( 1.350) +Creep Secondary( 1.200)
            +Shrinkage Secondary( 1.200)
     2  1    peso proprio( 1.350) + getto soletta( 1.350) +marciapiede destro( 1.350)
            +marciapiede sinistro( 1.350) +sicurvia destro( 1.350) +sicurvia sinistro( 1.350)
            +pavimentazione( 1.350) +       termica( 1.500) +Creep Secondary( 1.200)
            +Shrinkage Secondary( 1.200)
     3  1    peso proprio( 1.350) + getto soletta( 1.350) +marciapiede destro( 1.350)
            +marciapiede sinistro( 1.350) +sicurvia destro( 1.350) +sicurvia sinistro( 1.350)
            +pavimentazione( 1.350) +       termica(-1.500) +Creep Secondary( 1.200)
            +Shrinkage Secondary( 1.200)
```

4 2 peso proprio(1.000) + getto soletta(1.000) +marciapiede destro(1.000)
+marciapiede sinistro(1.000) +sicurvia destro(1.000) +sicurvia sinistro(1.000)
+pavimentazione(1.000) + MVmaxMVL1Fz2(1.000) +Creep Secondary(1.000)
+Shrinkage Secondary(1.000)

5 2 peso proprio(1.000) + getto soletta(1.000) +marciapiede destro(1.000)
+marciapiede sinistro(1.000) +sicurvia destro(1.000) +sicurvia sinistro(1.000)
+pavimentazione(1.000) + termica(0.600) +Creep Secondary(1.000)
+Shrinkage Secondary(1.000)

6 2 peso proprio(1.000) + getto soletta(1.000) +marciapiede destro(1.000)
+marciapiede sinistro(1.000) +sicurvia destro(1.000) +sicurvia sinistro(1.000)
+pavimentazione(1.000) + termica(0.500) +Creep Secondary(1.000)
+Shrinkage Secondary(1.000)

7+ 1 peso proprio(1.350) + getto soletta(1.350) +marciapiede destro(1.350)
+marciapiede sinistro(1.350) +sicurvia destro(1.350) +sicurvia sinistro(1.350)
+pavimentazione(1.350) + MVL2(1.350) +Creep Secondary(1.200)
+Shrinkage Secondary(1.200)

7- 1 peso proprio(1.350) + getto soletta(1.350) +marciapiede destro(1.350)
+marciapiede sinistro(1.350) +sicurvia destro(1.350) +sicurvia sinistro(1.350)
+pavimentazione(1.350) + MVL2(1.350) +Creep Secondary(1.200)
+Shrinkage Secondary(1.200)

8 1 peso proprio(1.350) + getto soletta(1.350) +marciapiede destro(1.350)
+marciapiede sinistro(1.350) +sicurvia destro(1.350) +sicurvia sinistro(1.350)
+pavimentazione(1.350) + MVmaxMVL1Fz2(1.350) +Creep Secondary(1.200)
+Shrinkage Secondary(1.200)

9 1 peso proprio(1.350) + getto soletta(1.350) +marciapiede destro(1.350)
+marciapiede sinistro(1.350) +sicurvia destro(1.350) +sicurvia sinistro(1.350)
+pavimentazione(1.350) + MVmaxMVL1My10(1.350) +Creep Secondary(1.200)
+Shrinkage Secondary(1.200)

10 1 peso proprio(1.350) + getto soletta(1.350) +marciapiede destro(1.350)
+marciapiede sinistro(1.350) +sicurvia destro(1.350) +sicurvia sinistro(1.350)
+pavimentazione(1.350) +MVmaxMVL1My146(1.350) +Creep Secondary(1.200)
+Shrinkage Secondary(1.200)

11 1 peso proprio(1.350) + getto soletta(1.350) +marciapiede destro(1.350)
+marciapiede sinistro(1.350) +sicurvia destro(1.350) +sicurvia sinistro(1.350)
+pavimentazione(1.350) +MVmaxMVL1Fz140(1.350) +Creep Secondary(1.200)
+Shrinkage Secondary(1.200)

12 1 peso proprio(1.350) + getto soletta(1.350) +marciapiede destro(1.350)
+marciapiede sinistro(1.350) +sicurvia destro(1.350) +sicurvia sinistro(1.350)
+pavimentazione(1.350) + MVmaxMVL1My39(1.350) +Creep Secondary(1.200)
+Shrinkage Secondary(1.200)

*. PROJECT :
*. MEMBER NO = 146, ELEMENT TYPE = Beam
*. LOADCOMB NO = 10, MATERIAL NO = 1, SECTION NO = 8
*. UNIT SYSTEM : kN, cm

*. SECTION PROPERTIES : Designation = concio B sx
Shape = I - Section. (Tapered)
<Pos J> (Checking Position).
Depth = 360.000, Top F Width = 100.000, Bot.F Width = 100.000
Web Thick = 2.200, Top F Thick = 10.000, Bot.F Thick = 10.000
<Pos I>.
Depth = 357.493, Top F Width = 100.000, Bot.F Width = 100.000
Web Thick = 2.200, Top F Thick = 10.000, Bot.F Thick = 10.000
<Pos J>.
Depth = 360.000, Top F Width = 100.000, Bot.F Width = 100.000
Web Thick = 2.200, Top F Thick = 10.000, Bot.F Thick = 10.000

<Pos J> (Checking Position).
Area = 2.74800e+003, Asy = 2.00000e+003, Asz = 8.97600e+002
Ybar = 5.00000e+001, Zbar = 1.80000e+002, Qyb = 9.39955e+004, Qzb = 1.25000e+003
Wely = 3.80402e+005, Welz = 3.33394e+004, Wply = 4.13580e+005, Wplz = 5.04114e+004
Iyy = 6.84724e+007, Izz = 1.66697e+006, Iyz = 0.00000e+000
iy = 1.57852e+002, iz = 2.46295e+001
<Pos I>.
Area = 2.74249e+003, Asy = 1.33333e+003, Asz = 7.86485e+002
Ybar = 5.00000e+001, Zbar = 1.78747e+002, Qyb = 9.32134e+004, Qzb = 1.25000e+003
Wely = 3.77294e+005, Welz = 3.33393e+004, Wply = 4.10139e+005, Wplz = 5.04084e+004
Iyy = 6.74400e+007, Izz = 1.66697e+006, Iyz = 0.00000e+000
iy = 1.56815e+002, iz = 2.46542e+001
<Pos J>.
Area = 2.74800e+003, Asy = 1.33333e+003, Asz = 7.92000e+002
Ybar = 5.00000e+001, Zbar = 1.80000e+002, Qyb = 9.39955e+004, Qzb = 1.25000e+003
Wely = 3.80402e+005, Welz = 3.33394e+004, Wply = 4.13580e+005, Wplz = 5.04114e+004
Iyy = 6.84724e+007, Izz = 1.66697e+006, Iyz = 0.00000e+000
iy = 1.57852e+002, iz = 2.46295e+001

*. DESIGN PARAMETERS FOR STRENGTH EVALUATION :
Ly = 1.09450e+002, Lz = 1.09450e+002, Lu = 1.09450e+002
Ky = 1.00000e+000, Kz = 1.00000e+000

*. MATERIAL PROPERTIES :

Fy = 3.35000e+001, Es = 2.10000e+004, MATERIAL NAME = S355

*. FORCES AND MOMENTS AT (J) POINT :

Axial Force Fxx =-1.46562e+003

Shear Forces Fyy = 2.66831e+001, Fzz =-1.45186e+003

Bending Moments My = 9.08550e+006, Mz =-2.34227e+004

End Moments Myi = 8.92482e+006, Myj = 9.08550e+006 (for Lb)

Myi = 8.92482e+006, Myj = 9.08550e+006 (for Ly)

Mzi =-1.99134e+004, Mzj =-2.34227e+004 (for Lz)

*. Sign conventions for stress and axial force.

- Stress : Compression positive.
- Axial force: Tension positive.

( ). Determine classification of compression outstand flanges.

[Eurocode3:05 Table 5.2 (Sheet 2 of 3), EN 1993-1-5]

-. e = SQRT(235/fy) = 0.84

-. b/t = BTR = 4.89

-. sigma1 = 22.966 kN/cm^2.

-. sigma2 = 22.512 kN/cm^2.

-. BTR < 9*e (Class 1 : Plastic).

==

[[[*]]] CLASSIFY RIGHT-TOP FLANGE OF SECTION (BTR).

==

( ). Determine classification of compression outstand flanges.

[Eurocode3:05 Table 5.2 (Sheet 2 of 3), EN 1993-1-5]

-. e = SQRT(235/fy) = 0.84

-. b/t = BTR = 4.89

-. sigma1 = 22.491 kN/cm^2.

-. sigma2 = 22.037 kN/cm^2.

-. BTR < 9*e (Class 1 : Plastic).

==

[[[*]]] CLASSIFY LEFT-BOTTOM FLANGE OF SECTION (BTR).

==

( ). Determine classification of tension outstand flanges.

-. Not Checking the Section Classification.

==
[[[*]]] CLASSIFY RIGHT-BOTTOM FLANGE OF SECTION (BTR).
==

( ). Determine classification of tension outstand flanges.
-. Not Checking the Section Classification.

==
[[[*]]] CLASSIFY WEB OF SECTION (HTR).
==

( ). Determine classification of bending and compression Internal Parts.
[Eurocode3:05 Table 5.2 (Sheet 1 of 3), EN 1993-1-5]
-. e = SQRT(235/fy) = 0.84
-. d/t = HTR = 154.55
-. sigma1 = 23.090 kN/cm^2.
-. sigma2 = -22.024 kN/cm^2.
-. Psi = [2*(Nsd/A)*(1/fy)]-1 = -0.968
-. RatPsi = 1 / (0.67 + 0.33*Psi) = 2.853
-. HTR > 42*e*RatPsi (Class 4 : Slender).

==
[[[*]]] CALCULATE EFFECTIVE AREA.
==

( ). Calculate cross-section properties of left-top flange.
[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]
-. r = 1.100 cm.
-. bc = 48.900 cm.
-. beff = bc + r = 50.000 cm.
-. Aeff = beff * tf = 500.000 cm^2.

( ). Calculate cross-section properties of right-top flange.
[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]
-. r = 1.100 cm.
-. bc = 48.900 cm.
-. beff = bc + r = 50.000 cm.
-. Aeff = beff * tf = 500.000 cm^2.

( ). Calculate cross-section properties of left-bottom flange.
[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]

-. r = 1.100 cm.
-. bc = 48.900 cm.
-. beff = bc + r = 50.000 cm.
-. Aeff = beff * tf = 500.000 cm^2.

( ). Calculate cross-section properties of right-bottom flange.
[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]
-. r = 1.100 cm.
-. bc = 48.900 cm.
-. beff = bc + r = 50.000 cm.
-. Aeff = beff * tf = 500.000 cm^2.

( ). Calculate buckling factor of internal compression element.
[Eurocode3 Part 1-5 4.4, Table 4.1]
-. In case of Psi = 1.0
-. k_sigma = 4.0000

( ). Calculate effective cross-section properties of web of Class 4 (Internal element).
[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]
-. RatT =154.5455
-. Lambda_p = RatT / [28.4*Eps*SQRT(k_sigma)] = 3.2486
-. Rho = MIN[(Lambda_p-0.055*(3+psi)) / Lambda_p^2, 1.0] = 0.2870
-. sigma_max = MAX(sigma1, sigma2) = 0.533 kN/cm^2.
-. sigma_min = MIN(sigma1, sigma2) = 0.533 kN/cm^2.
-. r = 0.000 cm.
-. Ar = 0.000 cm^2.
-. dc = 340.000 cm.
-. deff1 = 2*(Rho*dc) / [5 - sigma_min/sigma_max] + r = 48.786 cm.
-. Aeff1 = deff1 * tw + 2*Ar = 107.330 cm^2.
-. zeff1 = deff1/2 + tf = 34.393 cm.
-. deff2 = (Rho*dc) - deff1 + r = 48.786 cm.
-. Aeff2 = deff2 * tw + 2*Ar = 107.330 cm^2.
-. zeff2 = (h+2*r) - deff2/2 + tf = 325.607 cm.

==
[[[*]]] CALCULATE EFFECTIVE SECTION MODULUS ABOUT MAJOR AXIS.
==

( ). Calculate cross-section properties of left-top flange.
[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]
-. r = 1.100 cm.

-. bc   =   48.900 cm.

-. beff = bc + r   =   50.000 cm.

-. Aeff = beff * tf =   500.000 cm^2.

-. yeff = beff/2   =   25.000 cm.

( ). Calculate cross-section properties of right-top flange.

[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]

-. r   =   1.100 cm.

-. bc   =   48.900 cm.

-. beff = bc + r   =   50.000 cm.

-. Aeff = beff * tf =   500.000 cm^2.

-. yeff = beff/2   =   25.000 cm.

( ). Calculate cross-section properties of left-bottom flange.

[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]

-. r   =   1.100 cm.

-. bc   =   48.900 cm.

-. beff = bc + r   =   50.000 cm.

-. Aeff = beff * tf =   500.000 cm^2.

-. yeff = beff/2   =   25.000 cm.

( ). Calculate cross-section properties of right-bottom flange.

[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]

-. r   =   1.100 cm.

-. bc   =   48.900 cm.

-. beff = bc + r   =   50.000 cm.

-. Aeff = beff * tf =   500.000 cm^2.

-. yeff = beff/2   =   25.000 cm.

( ). Calculate buckling factor of internal compression element.

[Eurocode3 Part 1-5 4.4, Table 4.1]

-. In case of Psi = -1.0

-. k_sigma = 23.9000

( ). Calculate effective cross-section properties of web of Class 4 (Internal element).

[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]

-. RatT   =154.5455

-. Lambda_p = RatT / [28.4*Eps*SQRT(k_sigma)] = 1.3290

-. Rho   = MIN[(Lambda_p-0.055*(3+psi)) / Lambda_p^2, 1.0] = 0.6902

-. sigma_max = MAX(sigma1, sigma2) =   22.557 kN/cm^2.

-. sigma_min = MIN(sigma1, sigma2) = -22.557 kN/cm^2.
-. r = 0.000 cm.
-. Ar = 0.000 cm^2.
-. dc = (h*sigma_max) / (sigma_max-sigma_min) = 170.000 cm.
-. deff1 = 0.4*Rho*dc + r = 46.931 cm.
-. Aeff1 = deff1 * tw + 2*Ar = 103.248 cm^2.
-. zeff1 = (h+2*r) - deff1/2 + tf = 326.534 cm.
-. deff2 = 0.6*Rho*dc + (h-dc) + r = 240.397 cm.
-. Aeff2 = deff2 * tw + 2*Ar = 528.873 cm^2.
-. zeff2 = deff2/2 + tf = 130.198 cm.

==
[[[*]]] CALCULATE EFFECTIVE SECTION MODULUS ABOUT MINOR AXIS.
==

( ). Calculate cross-section properties of left-top flange.
[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]
-. r = 1.100 cm.
-. bc = 48.900 cm.
-. beff = bc + r = 50.000 cm.
-. Aeff = beff * tf = 500.000 cm^2.
-. yeff = beff/2 = 25.000 cm.

( ). Calculate cross-section properties of right-top flange.
[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]
-. r = 1.100 cm.
-. bc = 48.900 cm.
-. beff = bc + r = 50.000 cm.
-. Aeff = beff * tf = 500.000 cm^2.
-. yeff = beff/2 = 25.000 cm.

( ). Calculate cross-section properties of left-bottom flange.
[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]

-. r = 1.100 cm.
-. bc = 48.900 cm.
-. beff = bc + r = 50.000 cm.
-. Aeff = beff * tf = 500.000 cm^2.
-. yeff = beff/2 = 25.000 cm.

( ). Calculate cross-section properties of right-bottom flange.

[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]

-. r = 1.100 cm.

-. bc = 48.900 cm.

-. beff = bc + r = 50.000 cm.

-. Aeff = beff * tf = 500.000 cm^2.

-. yeff = beff/2 = 25.000 cm.

( ). Calculate effective cross-section properties of web of Class 4 (Internal element).

[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]

-. Rho = 1.0 (Only tensile stresses).

-. sigma_max = MAX(sigma1, sigma2) = 0.000 kN/cm^2.

-. sigma_min = MIN(sigma1, sigma2) = 0.000 kN/cm^2.

-. r = 0.000 cm.

-. Ar = 0.000 cm^2.

-. dc = 340.000 cm.

-. deff = dc + r = 340.000 cm.

-. Aeff = deff * tw + 4*Ar = 748.000 cm^2.

-. zeff = (h+2*r) - deff/2 = 180.000 cm.

==

[[[*]]] EFFECTIVE SECTION PPOPERTIES.

==

( ). Calculated effective cross-section properties of Class4 cross-section.

-. Aeff = 2214.6599 cm^2. (for calculating axial resistance)

-. Aeffy = 2632.1209 cm^2.

-. Weffy = 365321.0377 cm^3.

-. Aeffz = 2748.0000 cm^2.

-. Weffz = 33339.3672 cm^3.

-. eNy = 0.0000 cm.

-. eNz = 0.0000 cm.

==

[[[*]]] APPLIED FACTORS.

==

( ). Calculate equivalent uniform moment factors (Cmy,Cmz,CmLT).

[Eurocode3:05 Annex A. Table A.1, A.2]

-. Cmy,0 = 0.996

-. Cmz,0 = 0.969

-. Cmy (Default or User Defined Value) = 1.000

-. Cmz (Default or User Defined Value) = 1.000
-. CmLT (Default or User Defined Value) = 1.000

( ). Partial Factors (Gamma_Mi).
[Eurocode3:05 6.1]
-. Gamma_M0 = 1.00
-. Gamma_M1 = 1.10
-. Gamma_M2 = 1.25

==
[[[*]]] CHECK AXIAL RESISTANCE.
==

( ). Check slenderness ratio of axial compression member (Kl/i).
[Eurocode3:05 6.3.1]
-. Kl/i = 4.4 < 200.0 ---> O.K.

( ). Calculate axial compressive resistance (Nc_Rd).
[Eurocode3:05 6.1, 6.2.4]
-. Nc_Rd = fy * Aeff / Gamma_M0 = 74191.11 kN.

( ). Check ratio of axial resistance (N_Ed/Nc_Rd).

```
      N_Ed          1465.62
-. -----  =  ---------------  =  0.020  <  1.000  --->  O.K.
     Nc_Rd         74191.11
```

( ). Calculate buckling resistance of compression member (Nb_Rdy, Nb_Rdz).
[Eurocode3:05 6.3.1.1, 6.3.1.2]
-. Beta_A = Aeff / Area = 0.806
-. Lambda1 = Pi * SQRT(Es/fy) = 78.657
-. Lambda_by = {(Ky*Ly/iy)/Lambda1} * SQRT(Beta_A) = 0.008
-. Ncry = Pi^2*Es*Iyy / (Ky*Ly)^2 = 1184685461.30 kN.
-. Lambda_by < 0.2 or N_Ed/Ncry < 0.04 --> No need to check.

-. Lambda_bz = {(Kz*Lz/iz)/Lambda1} * SQRT(Beta_A) = 0.051
-. Ncrz = Pi^2*Es*Izz / (Kz*Lz)^2 = 28841302.20 kN.
-. Lambda_bz < 0.2 or N_Ed/Ncrz < 0.04 --> No need to check.

==
[[[*]]] CHECK SHEAR RESISTANCE.
==

( ). Calculate shear area.
[Eurocode3:05 6.2.6, EN1993-1-5:04 5.1 NOTE 2]
-. eta = 1.2 (Fy < 460 MPa.)
-. Avy = 2*B*tf = 2000.0000 cm^2.
-. Avz = eta*hw*tw = 897.6000 cm^2.

( ). Calculate plastic shear resistance in local-y direction (Vpl_Rdy).
[Eurocode3:05 6.1, 6.2.6]
-. Vpl_Rdy = [Avy*fy/SQRT(3)] / Gamma_M0 = 38682.47 kN.

( ). Check ratio of shear resistance (V_Edy/Vpl_Rdy).
(LCB = 7-, POS = J)
-. Applied shear force : V_Edy = 931.02 kN.
V_Edy 931.02
-. ------- = --------------- = 0.024 < 1.000 ---> O.K.
Vpl_Rdy 38682.47

( ). Calculate plastic shear resistance in local-z direction (Vpl_Rdz).
[Eurocode3:05 6.1, 6.2.6]
-. Vpl_Rdz = [Avz*fy/SQRT(3)] / Gamma_M0 = 17360.69 kN.

( ). Shear Buckling Check.
[Eurocode3:05 6.2.6]
-. HTR > 72*e/Eta ---> Need to check!

( ). Calculate shear buckling resistance in local-z direction (Vbl_Rdz).
[Eurocode3:05 6.1, 6.2.6, EN 1993-1-5:2004 5.2]
-. Eta = 1.20
-. Lambda_w = hw / (86.4*tw*e) = 2.1357
-. Chi_w = 0.83/Lambda_w = 0.39
-. Vbw_Rdz = Chi_w*fy*hw*tw / [sqrt(3)*Gamma_M1] = 5111.40 kN.

-. Af1 = 1000.0000 cm^2.
-. Af2 = 1000.0000 cm^2.
-. Mfk = Af1*fy*(H-Zbar-tf/2) + Af2*fy*(Zbar-tf/2) = 11725000.00 kN-cm.
-. rf = 1-[Ned/{(Af1+Af2)*fy/Gamma_M0}] = 0.9781(0<rf<1)
-. Mf_Rd = rf*Mfk/Gamma_M0 = 11468517.24 kN-cm.
-. In case of M_Ed < Mf_Rd
-. a = Ly = 109.4500 cm.
-. bf = min(B, 30*e*tf) = 100.0000 cm.

-. c = a*[0.25 + (1.6*bf*tf^2*fy)/(tw*hw^2*fy)] = 34.2483 cm.
-. Vbf_Rdz = (bf*tf^2*fy)/(c*Gamma_M1)*[1-(M_Ed/Mf_Rd)^2] = 3311.48 kN.

-. Vb_Rdz1 = Vw_Rdz + Vf_Rdz = 8422.88 kN.
-. Vb_Rdz2 = Eta*fy*hw*tw / [sqrt(3)*Gamma_M1] = 15782.45 kN.
-. Vb_Rdz = min[Vbw_rdz1, Vbw_rdz2] = 8422.88 kN.

( ). Check ratio of shear resistance (V_Edz/Vb_Rdz).
(LCB = 9, POS = I)
-. Applied shear force : V_Edz = 1722.71 kN.
V_Edz 1722.71
-. -------- = --------------- = 0.205 < 1.000 ---> O.K.
Vb_Rdz 8422.88

==
[[[*]]] CHECK BENDING MOMENT RESISTANCE ABOUT MAJOR AXIS.
==

( ). Calculate local buckling resistance moment about major axis.
[Eurocode3:05 6.1, 6.2.5]
-. Weffy = 365321.0377 cm^3.
-. Mc_Rdy = Weffy * fy / Gamma_M0 = 12238254.76 kN-cm.

( ). Check ratio of moment resistance (M_Edy/Mc_Rdy).
M_Edy 9085501.73
-. ------ = --------------- = 0.742 < 1.000 ---> O.K.
Mc_Rdy 12238254.76

==
[[[*]]] CHECK BENDING MOMENT RESISTANCE ABOUT MINOR AXIS.
==

( ). Calculate local buckling resistance moment about minor axis.
[Eurocode3:05 6.1, 6.2.5]
-. Weffz = 33339.3672 cm^3.
-. Mc_Rdz = Weffz * fy / Gamma_M0 = 1116868.80 kN-cm.

( ). Check ratio of moment resistance (M_Edz/Mc_Rdz).
M_Edz 23422.72
-. ------ = --------------- = 0.021 < 1.000 ---> O.K.
Mc_Rdz 1116868.80

==

[[[*]]]   CHECK LATERAL-TORSIONAL BUCKLING RESISTANCE.

==

( ). Calculate lateral-torsional buckling resistance (Mb_Rd).

[Eurocode3:05 6.1, 6.3.2]

-. Por   =   0.300

-. Gs   = Es / [2*(1+Por)] =   8076.923 kN/cm^2.

-. Ncr   = Pi^2*Es*Izz / Lu^2 =   28841302.20 kN.

-. psi   =   0.982

-. C1   =   1.285

-. Mcr   = C1 * Ncr * SQRT [(Cwp/Izz) + (Gs*Ixx)/Ncr] = 6487114535.24 kN-cm.

-. Lambda_LT_bar = SQRT [Weffy*fy / Mcr] =   0.043

-. Lambda_LT_bar0 =   0.200

-. Lambda_LT_bar =   0.043 < Lambda_LT_bar0   =   0.200

-. M_Ed/Mcr   =   0.001 < Lambda_LT_bar0^2 =   0.040

If Lambda_LT_bar < Lambda_LT_bar0 or M_Ed/Mcr < Lambda_LT_bar0^2,

No allowance for lateral-torsional buckling necessary.

==

[[[*]]]   CHECK INTERACTION OF COMBINED RESISTANCE.

==

( ). Calculate Major reduced design resistance of bending and shear.

[Eurocode3:05 6.2.8 (6.30)]

-. In case of V_Edz / Vpl_Rdz < 0.5

-. My_Rd = Mc_Rdy =   12238254.76 kN-cm.

( ). Calculate Minor reduced design resistance of bending and shear.

[Eurocode3:05 6.2.8 (6.30)]

-. In case of V_Edy / Vpl_Rdy < 0.5

-. Mz_Rd = Mc_Rdz =   1116868.80 kN-cm.

( ). Check interaction ratio of bending and axial force.

[Eurocode3:05 6.2.9.3 (6.44)] - Class4

```
                N_Ed          M_Edy + N_Ed*eNz     M_Edz + N_Ed*eNy
-. Rmax1  = ---------------- + ------------------ + ------------------
           Aeff*fy/Gamma_M0        My_Rd                Mz_Rd
```

```
              =  0.783  <  1.000  --->  O.K.

   ( ). Check interaction ratio of bending and axial compression member.
        [ Eurocode3:05  6.3.1, 6.2.9.3 (6.61, 6.62), Annex A ]
        -. N_Ed     =      -1465.62 kN.
        -. M_Edy    =    9085501.73 kN-cm.
        -. M_Edz    =     -23422.72 kN-cm.
        -. kyy      =   1.000
        -. kyz      =   1.000
        -. kzy      =   1.000
        -. kzz      =   1.000
        -. Xiy      =   1.000
        -. Xiz      =   1.000
        -. XiLT     =   1.000
        -. Aeff     =     2214.6599 cm^2.
        -. Weffy    =   365321.0377 cm^3.
        -. Weffz    =    33339.3672 cm^3.
        -. eNy      =    0.0000 cm.
        -. eNz      =    0.0000 cm.
        -. N_Rk     = Aeff*fy  =      74191.11 kN.
        -. My_Rk    = Weffy*fy =   12238254.76 kN-cm.
        -. Mz_Rk    = Weffz*fy =    1116868.80 kN-cm.
        -. N_Ed*eNy =          0.00 kN-cm.
        -. N_Ed*eNZ =          0.00 kN-cm.
                          N_Ed                M_Edy + N_Ed*eNy          M_Edz + N_Ed*eNz
        -. Rmax_LT1 = ----------------- + kyy * ------------------- + kyz * ----------------
                    Xiy*N_Rk/Gamma_M1        XiLT*My_Rk/Gamma_M1         Mz_Rk/Gamma_M1
                   =  0.861  <  1.000  --->  O.K.
                          N_Ed                M_Edy + N_Ed*eNy          M_Edz + N_Ed*eNz
        -. Rmax_LT2 = ----------------- + kzy * ------------------- + kzz * ----------------
                    Xiz*N_Rk/Gamma_M1        XiLT*My_Rk/Gamma_M1         Mz_Rk/Gamma_M1
                   =  0.861  <  1.000  --->  O.K.

        -. Rmax   = MAX[ Rmax1, MAX(Rmax_LT1, Rmax_LT2) ] =  0.861  <  1.000  --->  O.K.

============================================================================
  [[[*]]]   CHECK DEFLECTION.
============================================================================

   ( ). Compute Maximum Deflection.
        -. LCB      =    4
```

-. DAF   =   1.000 (Deflection Amplification Factor).

-. Position =   54.725cm From i-end(Node 77).

-. Def   =   -0.006 * DAF =   -0.006cm (Golbal Z)

-. Def_Lim =   0.438cm

Def < Def_Lim   ---> O.K !

6.6.4. Verifica di dettaglio Concio A

```
-----------------------------------------------------------------------------------------
 MIDAS/Civil - Steel Code Checking[ Eurocode3-2:05 ]                    Version 8.5.6
==================================================================

    +=============================================================+
    | MIDAS(Modeling, Integrated Design & Analysis Software)    |
    | MIDAS/Civil - Design & checking system for windows        |
    +=============================================================+
    | Steel Member Applicable Code Checking                     |
    | Based On  AASHTO-LRFD12, AASHTO-LRFD02, AASHTO-LFD96,     |
    |           AASHTO-ASD96, AISC-LRFD2K, AISC-LRFD93,         |
    |           AISC-ASD89, Eurocode3-2:05, BS5950-90,          |
    |           IS:800-2007, IS:800-1984                        |
    |                                  (c)SINCE 1989  |
    +=============================================================+
    | MIDAS Information Technology Co.,Ltd.        (MIDAS IT)  |
    | MIDAS IT Design Development Team                          |
    +=============================================================+
    |           HomePage : www.MidasUser.com                    |
    +=============================================================+
    | MIDAS/Civil  Version 8.5.6                                |
    +=============================================================+

   *. DEFINITION OF LOAD COMBINATIONS WITH SCALING UP FACTORS.
-------------------------------------------------------------------------------------
    LCB  C    Loadcase Name(Factor) + Loadcase Name(Factor) + Loadcase Name(Factor)
-------------------------------------------------------------------------------------
      1  1    peso proprio( 1.350) + getto soletta( 1.350) +marciapiede destro( 1.350)
             +marciapiede sinistro( 1.350) +sicurvia destro( 1.350) +sicurvia sinistro( 1.350)
             +pavimentazione( 1.350) + MVmaxMVL1My47( 1.350) +Creep Secondary( 1.200)
             +Shrinkage Secondary( 1.200)
      2  1    peso proprio( 1.350) + getto soletta( 1.350) +marciapiede destro( 1.350)
             +marciapiede sinistro( 1.350) +sicurvia destro( 1.350) +sicurvia sinistro( 1.350)
             +pavimentazione( 1.350) +       termica( 1.500) +Creep Secondary( 1.200)
             +Shrinkage Secondary( 1.200)
      3  1    peso proprio( 1.350) + getto soletta( 1.350) +marciapiede destro( 1.350)
             +marciapiede sinistro( 1.350) +sicurvia destro( 1.350) +sicurvia sinistro( 1.350)
             +pavimentazione( 1.350) +       termica(-1.500) +Creep Secondary( 1.200)
             +Shrinkage Secondary( 1.200)
```

4 2 peso proprio(1.000) + getto soletta(1.000) +marciapiede destro(1.000)
+marciapiede sinistro(1.000) +sicurvia destro(1.000) +sicurvia sinistro(1.000)
+pavimentazione(1.000) + MVmaxMVL1Fz2(1.000) +Creep Secondary(1.000)
+Shrinkage Secondary(1.000)

5 2 peso proprio(1.000) + getto soletta(1.000) +marciapiede destro(1.000)
+marciapiede sinistro(1.000) +sicurvia destro(1.000) +sicurvia sinistro(1.000)
+pavimentazione(1.000) + termica(0.600) +Creep Secondary(1.000)
+Shrinkage Secondary(1.000)

6 2 peso proprio(1.000) + getto soletta(1.000) +marciapiede destro(1.000)
+marciapiede sinistro(1.000) +sicurvia destro(1.000) +sicurvia sinistro(1.000)
+pavimentazione(1.000) + termica(0.500) +Creep Secondary(1.000)
+Shrinkage Secondary(1.000)

7+ 1 peso proprio(1.350) + getto soletta(1.350) +marciapiede destro(1.350)
+marciapiede sinistro(1.350) +sicurvia destro(1.350) +sicurvia sinistro(1.350)
+pavimentazione(1.350) + MVL2(1.350) +Creep Secondary(1.200)
+Shrinkage Secondary(1.200)

7- 1 peso proprio(1.350) + getto soletta(1.350) +marciapiede destro(1.350)
+marciapiede sinistro(1.350) +sicurvia destro(1.350) +sicurvia sinistro(1.350)
+pavimentazione(1.350) + MVL2(1.350) +Creep Secondary(1.200)
+Shrinkage Secondary(1.200)

8 1 peso proprio(1.350) + getto soletta(1.350) +marciapiede destro(1.350)
+marciapiede sinistro(1.350) +sicurvia destro(1.350) +sicurvia sinistro(1.350)
+pavimentazione(1.350) + MVmaxMVL1Fz2(1.350) +Creep Secondary(1.200)
+Shrinkage Secondary(1.200)

9 1 peso proprio(1.350) + getto soletta(1.350) +marciapiede destro(1.350)
+marciapiede sinistro(1.350) +sicurvia destro(1.350) +sicurvia sinistro(1.350)
+pavimentazione(1.350) + MVmaxMVL1My10(1.350) +Creep Secondary(1.200)
+Shrinkage Secondary(1.200)

10 1 peso proprio(1.350) + getto soletta(1.350) +marciapiede destro(1.350)
+marciapiede sinistro(1.350) +sicurvia destro(1.350) +sicurvia sinistro(1.350)
+pavimentazione(1.350) +MVmaxMVL1My146(1.350) +Creep Secondary(1.200)
+Shrinkage Secondary(1.200)

11 1 peso proprio(1.350) + getto soletta(1.350) +marciapiede destro(1.350)
+marciapiede sinistro(1.350) +sicurvia destro(1.350) +sicurvia sinistro(1.350)
+pavimentazione(1.350) +MVmaxMVL1Fz140(1.350) +Creep Secondary(1.200)
+Shrinkage Secondary(1.200)

12 1 peso proprio(1.350) + getto soletta(1.350) +marciapiede destro(1.350)
+marciapiede sinistro(1.350) +sicurvia destro(1.350) +sicurvia sinistro(1.350)
+pavimentazione(1.350) + MVmaxMVL1My39(1.350) +Creep Secondary(1.200)
+Shrinkage Secondary(1.200)

*. PROJECT :
*. MEMBER NO = 140, ELEMENT TYPE = Beam
*. LOADCOMB NO = 7-, MATERIAL NO = 1, SECTION NO = 7
*. UNIT SYSTEM : kN, cm

*. SECTION PROPERTIES : Designation = concio A sx
Shape = I - Section. (Tapered)
<Pos J> (Checking Position).
Depth = 269.925, Top F Width = 100.000, Bot.F Width = 100.000
Web Thick = 2.000, Top F Thick = 8.000, Bot.F Thick = 8.000
<Pos I>.
Depth = 257.076, Top F Width = 100.000, Bot.F Width = 100.000
Web Thick = 2.000, Top F Thick = 8.000, Bot.F Thick = 8.000
<Pos J>.
Depth = 269.925, Top F Width = 100.000, Bot.F Width = 100.000
Web Thick = 2.000, Top F Thick = 8.000, Bot.F Thick = 8.000

<Pos J> (Checking Position).
Area = 2.10785e+003, Asy = 1.60000e+003, Asz = 6.09420e+002
Ybar = 5.00000e+001, Zbar = 1.34963e+002, Qyb = 6.04447e+004, Qzb = 1.25000e+003
Wely = 2.23612e+005, Welz = 2.66701e+004, Wply = 2.41779e+005, Wplz = 4.02539e+004
Iyy = 3.01792e+007, Izz = 1.33350e+006, Iyz = 0.00000e+000
iy = 1.19656e+002, iz = 2.51523e+001
<Pos I>.
Area = 2.08215e+003, Asy = 1.06667e+003, Asz = 5.14153e+002
Ybar = 5.00000e+001, Zbar = 1.28538e+002, Qyb = 5.70800e+004, Qzb = 1.25000e+003
Wely = 2.11294e+005, Welz = 2.66699e+004, Wply = 2.28320e+005, Wplz = 4.02411e+004
Iyy = 2.71593e+007, Izz = 1.33349e+006, Iyz = 0.00000e+000
iy = 1.14210e+002, iz = 2.53069e+001
<Pos J>.
Area = 2.10785e+003, Asy = 1.06667e+003, Asz = 5.39850e+002
Ybar = 5.00000e+001, Zbar = 1.34963e+002, Qyb = 6.04447e+004, Qzb = 1.25000e+003
Wely = 2.23612e+005, Welz = 2.66701e+004, Wply = 2.41779e+005, Wplz = 4.02539e+004
Iyy = 3.01792e+007, Izz = 1.33350e+006, Iyz = 0.00000e+000
iy = 1.19656e+002, iz = 2.51523e+001

*. DESIGN PARAMETERS FOR STRENGTH EVALUATION :
Ly = 1.82350e+002, Lz = 1.82350e+002, Lu = 1.82350e+002
Ky = 1.00000e+000, Kz = 1.00000e+000

*. MATERIAL PROPERTIES :

Fy = 3.35000e+001, Es = 2.10000e+004, MATERIAL NAME = S355

*. FORCES AND MOMENTS AT (J) POINT :

Axial Force Fxx =-2.22462e+003

Shear Forces Fyy =-9.55253e+002, Fzz =-5.80728e+003

Bending Moments My = 1.33302e+006, Mz =-7.90786e+004

End Moments Myi = 6.22163e+005, Myj = 1.33302e+006 (for Lb)

Myi = 6.22163e+005, Myj = 1.33302e+006 (for Ly)

Mzi =-1.13485e+005, Mzj =-7.90786e+004 (for Lz)

*. Sign conventions for stress and axial force.

- Stress : Compression positive.
- Axial force: Tension positive.

==

[[[*]]] CLASSIFY LEFT-TOP FLANGE OF SECTION (BTR).

==

( ). Determine classification of compression outstand flanges.

[Eurocode3:05 Table 5.2 (Sheet 2 of 3), EN 1993-1-5]

-. e = SQRT(235/fy) = 0.84

-. b/t = BTR = 6.13

-. sigma1 = 8.533 kN/cm^2.

-. sigma2 = 6.608 kN/cm^2.

-. BTR < 9*e (Class 1 : Plastic).

==

[[[*]]] CLASSIFY RIGHT-TOP FLANGE OF SECTION (BTR).

==

( ). Determine classification of compression outstand flanges.

[Eurocode3:05 Table 5.2 (Sheet 2 of 3), EN 1993-1-5]

-. e = SQRT(235/fy) = 0.84

-. b/t = BTR = 6.13

-. sigma1 = 6.529 kN/cm^2.

-. sigma2 = 4.604 kN/cm^2.

-. BTR < 9*e (Class 1 : Plastic).

==

[[[*]]] CLASSIFY LEFT-BOTTOM FLANGE OF SECTION (BTR).

==

( ). Determine classification of tension outstand flanges.
-. Not Checking the Section Classification.

==
[[[*]]]   CLASSIFY RIGHT-BOTTOM FLANGE OF SECTION (BTR).
==

( ). Determine classification of tension outstand flanges.
-. Not Checking the Section Classification.

==
[[[*]]]   CLASSIFY WEB OF SECTION (HTR).
==

( ). Determine classification of bending and compression Internal Parts.
[Eurocode3:05 Table 5.2 (Sheet 1 of 3), EN 1993-1-5]
-. e   = SQRT(235/fy) =   0.84
-. d/t   = HTR = 126.96
-. sigma1 =   6.663 kN/cm^2.
-. sigma2 =   -4.553 kN/cm^2.
-. Psi   = [2*(Nsd/A)*(1/fy)]-1 = -0.937
-. RatPsi = 1 / (0.67 + 0.33*Psi) =   2.772
-. HTR > 42*e*RatPsi (Class 4 : Slender).

==
[[[*]]]   CALCULATE EFFECTIVE AREA.
==

( ). Calculate cross-section properties of left-top flange.
[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]
-. r   =   1.000 cm.
-. bc   =   49.000 cm.
-. beff = bc + r   =   50.000 cm.
-. Aeff = beff * tf =   400.000 cm^2.

( ). Calculate cross-section properties of right-top flange.
[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]
-. r   =   1.000 cm.
-. bc   =   49.000 cm.
-. beff = bc + r   =   50.000 cm.

-. Aeff = beff * tf =   400.000 cm^2.

( ). Calculate cross-section properties of left-bottom flange.

[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]

-. r   =   1.000 cm.

-. bc   =   49.000 cm.

-. beff = bc + r   =   50.000 cm.

-. Aeff = beff * tf =   400.000 cm^2.

( ). Calculate cross-section properties of right-bottom flange.

[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]

-. r   =   1.000 cm.

-. bc   =   49.000 cm.

-. beff = bc + r   =   50.000 cm.

-. Aeff = beff * tf =   400.000 cm^2.

( ). Calculate buckling factor of internal compression element.

[Eurocode3 Part 1-5 4.4, Table 4.1]

-. In case of Psi = 1.0

-. k_sigma = 4.0000

( ). Calculate effective cross-section properties of web of Class 4 (Internal element).

[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]

-. RatT   =126.9625

-. Lambda_p = RatT / [28.4*Eps*SQRT(k_sigma)] = 2.6688

-. Rho   = MIN[(Lambda_p-0.055*(3+psi)) / Lambda_p^2, 1.0] = 0.3438

-. sigma_max = MAX(sigma1, sigma2) =   1.055 kN/cm^2.

-. sigma_min = MIN(sigma1, sigma2) =   1.055 kN/cm^2.

-. r   =   0.000 cm.

-. Ar   =   0.000 cm^2.

-. dc   =   253.925 cm.

-. deff1 = 2*(Rho*dc) / [5 - sigma_min/sigma_max] + r =   43.651 cm.

-. Aeff1 = deff1 * tw + 2*Ar   =   87.303 cm^2.

-. zeff1 = deff1/2 + tf   =   29.826 cm.

-. deff2 = (Rho*dc) - deff1 + r   =   43.651 cm.

-. Aeff2 = deff2 * tw + 2*Ar   =   87.303 cm^2.

-. zeff2 = (h+2*r) - deff2/2 + tf =   240.099 cm.

==

[[[*]]]   CALCULATE EFFECTIVE SECTION MODULUS ABOUT MAJOR AXIS.

==

( ). Calculate cross-section properties of left-top flange.
[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]
-. r = 1.000 cm.
-. bc = 49.000 cm.
-. beff = bc + r = 50.000 cm.
-. Aeff = beff * tf = 400.000 cm^2.
-. yeff = beff/2 = 25.000 cm.

( ). Calculate cross-section properties of right-top flange.
[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]
-. r = 1.000 cm.
-. bc = 49.000 cm.
-. beff = bc + r = 50.000 cm.
-. Aeff = beff * tf = 400.000 cm^2.
-. yeff = beff/2 = 25.000 cm.

( ). Calculate cross-section properties of left-bottom flange.
[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]
-. r = 1.000 cm.
-. bc = 49.000 cm.
-. beff = bc + r = 50.000 cm.
-. Aeff = beff * tf = 400.000 cm^2.
-. yeff = beff/2 = 25.000 cm.

( ). Calculate cross-section properties of right-bottom flange.
[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]

-. r = 1.000 cm.
-. bc = 49.000 cm.
-. beff = bc + r = 50.000 cm.
-. Aeff = beff * tf = 400.000 cm^2.
-. yeff = beff/2 = 25.000 cm.

( ). Calculate buckling factor of internal compression element.
[Eurocode3 Part 1-5 4.4, Table 4.1]
-. In case of Psi = -1.0
-. k_sigma = 23.9000

( ). Calculate effective cross-section properties of web of Class 4 (Internal element).
[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]

-. RatT =126.9625

-. Lambda_p = RatT / [28.4*Eps*SQRT(k_sigma)] = 1.0918

-. Rho = MIN[(Lambda_p-0.055*(3+psi)) / Lambda_p^2, 1.0] = 0.8236

-. sigma_max = MAX(sigma1, sigma2) = 5.608 kN/cm^2.

-. sigma_min = MIN(sigma1, sigma2) = -5.608 kN/cm^2.

-. r = 0.000 cm.

-. Ar = 0.000 cm^2.

-. dc = (h*sigma_max) / (sigma_max-sigma_min) = 126.963 cm.

-. deff1 = 0.4*Rho*dc + r = 41.828 cm.

-. Aeff1 = deff1 * tw + 2*Ar = 83.656 cm^2.

-. zeff1 = (h+2*r) - deff1/2 + tf = 241.011 cm.

-. deff2 = 0.6*Rho*dc + (h-dc) + r = 189.705 cm.

-. Aeff2 = deff2 * tw + 2*Ar = 379.410 cm^2.

-. zeff2 = deff2/2 + tf = 102.852 cm.

==

[[[*]]] CALCULATE EFFECTIVE SECTION MODULUS ABOUT MINOR AXIS.

==

( ). Calculate cross-section properties of left-top flange.

[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]

-. r = 1.000 cm.

-. bc = 49.000 cm.

-. beff = bc + r = 50.000 cm.

-. Aeff = beff * tf = 400.000 cm^2.

-. yeff = beff/2 = 25.000 cm.

( ). Calculate cross-section properties of right-top flange.

[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]

-. r = 1.000 cm.

-. bc = 49.000 cm.

-. beff = bc + r = 50.000 cm.

-. Aeff = beff * tf = 400.000 cm^2.

-. yeff = beff/2 = 25.000 cm.

( ). Calculate cross-section properties of left-bottom flange.

[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]

-. r = 1.000 cm.

-. bc = 49.000 cm.

-. beff = bc + r = 50.000 cm.

-. Aeff = beff * tf =   400.000 cm^2.

-. yeff = beff/2   =   25.000 cm.

( ). Calculate cross-section properties of right-bottom flange.

[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]

-. r   =   1.000 cm.

-. bc   =   49.000 cm.

-. beff = bc + r   =   50.000 cm.

-. Aeff = beff * tf =   400.000 cm^2.

-. yeff = beff/2   =   25.000 cm.

( ). Calculate effective cross-section properties of web of Class 4 (Internal element).

[Eurocode3 Part 1-5 4.4, Table 4.1, 4.2]

-. Rho   = 1.0 (Only tensile stresses).

-. sigma_max = MAX(sigma1, sigma2) =   0.000 kN/cm^2.

-. sigma_min = MIN(sigma1, sigma2) =   0.000 kN/cm^2.

-. r   =   0.000 cm.

-. Ar   =   0.000 cm^2.

-. dc   =   253.925 cm.

-. deff = dc + r   =   253.925 cm.

-. Aeff = deff * tw + 4*Ar =   507.850 cm^2.

-. zeff = (h+2*r) - deff/2 =   134.963 cm.

===

[[[*]]]   EFFECTIVE SECTION PPOPERTIES.

===

( ). Calculated effective cross-section properties of Class4 cross-section.

-. Aeff =   1774.6052 cm^2. (for calculating axial resistance)

-. Aeffy =   2063.0660 cm^2.

-. Weffy =   219138.2156 cm^3.

-. Aeffz =   2107.8500 cm^2.

-. Weffz =   26670.0523 cm^3.

-. eNy   =   0.0000 cm.

-. eNz   =   0.0000 cm.

===

[[[*]]]   APPLIED FACTORS.

===

( ). Calculate equivalent uniform moment factors (Cmy,Cmz,CmLT).

[Eurocode3:05 Annex A. Table A.1, A.2]

-. Cmy,0 = 0.888

-. Cmz,0 = 1.000

-. Cmy (Default or User Defined Value) = 1.000

-. Cmz (Default or User Defined Value) = 1.000

-. CmLT (Default or User Defined Value) = 1.000

( ). Partial Factors (Gamma_Mi).

[Eurocode3:05 6.1]

-. Gamma_M0 = 1.00

-. Gamma_M1 = 1.10

-. Gamma_M2 = 1.25

==

[[[*]]] CHECK AXIAL RESISTANCE.

==

( ). Check slenderness ratio of axial compression member (Kl/i).

[Eurocode3:05 6.3.1]

-. Kl/i = 7.2 < 200.0 ---> O.K.

( ). Calculate axial compressive resistance (Nc_Rd).

[Eurocode3:05 6.1, 6.2.4]

-. Nc_Rd = fy * Aeff / Gamma_M0 = 59449.27 kN.

( ). Check ratio of axial resistance (N_Ed/Nc_Rd).

```
     N_Ed          2224.62
-. -----  =  ---------------  =  0.037  <  1.000  --->  O.K.
    Nc_Rd          59449.27
```

( ). Calculate buckling resistance of compression member (Nb_Rdy, Nb_Rdz).

[Eurocode3:05 6.3.1.1, 6.3.1.2]

-. Beta_A = Aeff / Area = 0.842

-. Lambda1 = Pi * SQRT(Es/fy) = 78.657

-. Lambda_by = {(Ky*Ly/iy)/Lambda1} * SQRT(Beta_A) = 0.018

-. Ncry = Pi^2*Es*Iyy / (Ky*Ly)^2 = 188111311.55 kN.

-. Lambda_by < 0.2 or N_Ed/Ncry < 0.04 --> No need to check.

-. Lambda_bz = {(Kz*Lz/iz)/Lambda1} * SQRT(Beta_A) = 0.085

-. Ncrz = Pi^2*Es*Izz / (Kz*Lz)^2 = 8311920.43 kN.

-. Lambda_bz < 0.2 or N_Ed/Ncrz < 0.04 --> No need to check.

```
================================================================================
  [[[*]]]   CHECK SHEAR RESISTANCE.
================================================================================

    ( ). Calculate shear area.
         [ Eurocode3:05  6.2.6, EN1993-1-5:04 5.1 NOTE 2 ]
         -. eta   = 1.2 (Fy < 460 MPa.)
         -. Avy   = 2*B*tf    =      1600.0000 cm^2.
         -. Avz   = eta*hw*tw =       609.4200 cm^2.

    ( ). Calculate plastic shear resistance in local-y direction (Vpl_Rdy).
         [ Eurocode3:05  6.1, 6.2.6 ]
         -. Vpl_Rdy = [ Avy*fy/SQRT(3) ] / Gamma_M0 =      30945.97 kN.

    ( ). Check ratio of shear resistance (V_Edy/Vpl_Rdy).
         ( LCB =   7-, POS =    J )
         -. Applied shear force : V_Edy   =        955.25 kN.
              V_Edy            955.25
         -. -------  =  ---------------  =  0.031  <  1.000  --->  O.K.
             Vpl_Rdy          30945.97

    ( ). Calculate plastic shear resistance in local-z direction (Vpl_Rdz).
         [ Eurocode3:05  6.1, 6.2.6 ]
         -. Vpl_Rdz = [ Avz*fy/SQRT(3) ] / Gamma_M0 =      11786.94 kN.

    ( ). Shear Buckling Check.
         [ Eurocode3:05 6.2.6 ]
         -. HTR > 72*e/Eta   --->  Need to check!

    ( ). Calculate shear buckling resistance in local-z direction (Vbl_Rdz).
         [ Eurocode3:05  6.1, 6.2.6, EN 1993-1-5:2004 5.2 ]
         -. Eta      =  1.20
         -. Lambda_w = hw / (86.4*tw*e) =       1.7545
         -. Chi_w    = 0.83/Lambda_w    =  0.47
         -. Vbw_Rdz  = Chi_w*fy*hw*tw / [sqrt(3)*Gamma_M1] =       4224.30 kN.

         -. Af1     =      800.0000 cm^2.
         -. Af2     =      800.0000 cm^2.
         -. Mfk     = Af1*fy*(H-Zbar-tf/2) + Af2*fy*(Zbar-tf/2) =    7019590.41 kN-cm.
         -. rf      = 1-[Ned/{(Af1+Af2)*fy/Gamma_M0}]          =    0.9585(0<rf<1)
```

```
-. Mf_Rd   = rf*Mfk/Gamma_M0                        =    6728248.11 kN-cm.
-. In case of M_Ed < Mf_Rd
-. a        = Ly =  182.3500 cm.
-. bf       = min(B, 30*e*tf)                         =  100.0000 cm.
-. c        = a*[ 0.25 + (1.6*bf*tf^2*fy)/(tw*hw^2*fy)]    =   60.0674 cm.
-. Vbf_Rdz  = (bf*tf^2*fy)/(c*Gamma_M1)*[1-(M_Ed/Mf_Rd)^2] =       3117.47 kN.

-. Vb_Rdz1 = Vw_Rdz + Vf_Rdz                    =       7341.77 kN.
-. Vb_Rdz2 = Eta*fy*hw*tw / [sqrt(3)*Gamma_M1]   =      10715.40 kN.
-. Vb_Rdz  = min[ Vbw_rdz1, Vbw_rdz2 ]           =       7341.77 kN.

( ). Check ratio of shear resistance (V_Edz/Vb_Rdz).
   ( LCB =   7-, POS =    I )
   -. Applied shear force : V_Edz   =       5848.68 kN.
        V_Edz           5848.68
   -. --------  =  ---------------  =  0.797  <  1.000  --->  O.K.
       Vb_Rdz           7341.77

==================================================================================
  [[[*]]]   CHECK BENDING MOMENT RESISTANCE ABOUT MAJOR AXIS.
==================================================================================

( ). Calculate local buckling resistance moment about major axis.
   [ Eurocode3:05  6.1, 6.2.5 ]
   -. Weffy    =   219138.2156 cm^3.
   -. Mc_Rdy   = Weffy * fy / Gamma_M0 =    7341130.22 kN-cm.

( ). Check ratio of moment resistance (M_Edy/Mc_Rdy).
       M_Edy        1333015.25
   -. ------  =  ---------------  =  0.182  <  1.000  --->  O.K.
      Mc_Rdy        7341130.22

==================================================================================
  [[[*]]]   CHECK BENDING MOMENT RESISTANCE ABOUT MINOR AXIS.
==================================================================================

( ). Calculate local buckling resistance moment about minor axis.
   [ Eurocode3:05  6.1, 6.2.5 ]
   -. Weffz    =    26670.0523 cm^3.
   -. Mc_Rdz   = Weffz * fy / Gamma_M0 =     893446.75 kN-cm.
```

```
( ). Check ratio of moment resistance (M_Edz/Mc_Rdz).
        M_Edz          79078.56
     -. ------  =  ---------------  =  0.089  <  1.000  --->  O.K.
        Mc_Rdz         893446.75

================================================================================
  [[[*]]]   CHECK LATERAL-TORSIONAL BUCKLING RESISTANCE.
================================================================================

( ). Calculate lateral-torsional buckling resistance (Mb_Rd).
     [ Eurocode3:05  6.1, 6.3.2 ]
     -. Por       =   0.300
     -. Gs        = Es / [ 2*(1+Por) ]  =    8076.923 kN/cm^2.
     -. Ncr       = Pi^2*Es*Izz / Lu^2  =    8311920.43 kN.
     -. psi       =   0.467
     -. C1        =   1.285
     -. Mcr       = C1 * Ncr * SQRT [ (Cwp/Izz) + (Gs*Ixx)/Ncr ] = 1400077514.98 kN-cm.

     -. Lambda_LT_bar  = SQRT [ Weffy*fy / Mcr ] =   0.072
     -. Lambda_LT_bar0 =    0.200

     -. Lambda_LT_bar =    0.072 < Lambda_LT_bar0   =    0.200
     -. M_Ed/Mcr      = 9.521e-004 < Lambda_LT_bar0^2 =    0.040
     If Lambda_LT_bar < Lambda_LT_bar0 or M_Ed/Mcr < Lambda_LT_bar0^2,
     No allowance for lateral-torsional buckling necessary.

================================================================================
  [[[*]]]   CHECK INTERACTION OF COMBINED RESISTANCE.
================================================================================

( ). Calculate Major reduced design resistance of bending and shear.
     [ Eurocode3:05  6.2.8 (6.30) ]
     -. In case of V_Edz / Vpl_Rdz < 0.5
     -. My_Rd = Mc_Rdy =    7341130.22 kN-cm.

( ). Calculate Minor reduced design resistance of bending and shear.
     [ Eurocode3:05  6.2.8 (6.30) ]
     -. In case of V_Edy / Vpl_Rdy < 0.5
     -. Mz_Rd = Mc_Rdz =     893446.75 kN-cm.

( ). Check interaction ratio of bending and axial force.
```

[Eurocode3:05 6.2.9.3 (6.44)] - Class4

```
                N_Ed          M_Edy + N_Ed*eNz     M_Edz + N_Ed*eNy
-. Rmax1  = ---------------- + ------------------ + ------------------
          Aeff*fy/Gamma_M0        My_Rd               Mz_Rd
          =  0.308  <  1.000  --->  O.K.
```

( ). Check interaction ratio of bending and axial compression member.

[Eurocode3:05 6.3.1, 6.2.9.3 (6.61, 6.62), Annex A]

```
-. N_Ed     =      -2224.62 kN.
-. M_Edy    =    1333015.25 kN-cm.
-. M_Edz    =     -79078.56 kN-cm.
-. kyy      =   1.000
-. kyz      =   1.000
-. kzy      =   1.000
-. kzz      =   1.000
-. Xiy      =   1.000
-. Xiz      =   1.000
-. XiLT     =   1.000
-. Aeff     =     1774.6052 cm^2.
-. Weffy    =   219138.2156 cm^3.
-. Weffz    =    26670.0523 cm^3.
-. eNy      =    0.0000 cm.
-. eNz      =    0.0000 cm.
-. N_Rk     = Aeff*fy  =      59449.27 kN.
-. My_Rk    = Weffy*fy =    7341130.22 kN-cm.
-. Mz_Rk    = Weffz*fy =     893446.75 kN-cm.
-. N_Ed*eNy =          0.00 kN-cm.
-. N_Ed*eNZ =          0.00 kN-cm.
                  N_Ed                M_Edy + N_Ed*eNy          M_Edz + N_Ed*eNz
-. Rmax_LT1 = ----------------- + kyy * ------------------- + kyz * ----------------
              Xiy*N_Rk/Gamma_M1        XiLT*My_Rk/Gamma_M1         Mz_Rk/Gamma_M1
            =  0.338  <  1.000  --->  O.K.
                  N_Ed                M_Edy + N_Ed*eNy          M_Edz + N_Ed*eNz
-. Rmax_LT2 = ----------------- + kzy * ------------------- + kzz * ----------------
              Xiz*N_Rk/Gamma_M1        XiLT*My_Rk/Gamma_M1         Mz_Rk/Gamma_M1
            =  0.338  <  1.000  --->  O.K.

-. Rmax   = MAX[ Rmax1, MAX(Rmax_LT1, Rmax_LT2) ] =  0.338  <  1.000  --->  O.K.
```

==

[[[*]]]   CHECK DEFLECTION.

==

( ). Compute Maximum Deflection.

-. LCB = 4

-. DAF = 1.000 (Deflection Amplification Factor).

-. Position = 91.175cm From i-end(Node 71).

-. Def = -0.006 * DAF = -0.006cm (Golbal Z)

-. Def_Lim = 0.729cm

Def < Def_Lim ---> O.K !

6.6.5. Verifica di dettaglio dei traversi

Di seguito si riporta il dettaglio delle verifiche per le sezioni maggiormente sollecitate dei traversi tipologici intermedi e dei traversi di spalla.

TRAVERSI INTERMEDI

Element Number	47
Position Information	I

1 Design Condition

1.1 Design Parameters

■ **Partial factors**

γ_C for concrete	1.50	γ_V for headed sutd	1.25
γ_S for reinforcing steel	1.15	γ_{Ff} for equivalent constant Amplitude stress range	1.00
γ_{M0} for structural steel	1.00	γ_{Mf} for fatigue strength	1.00
γ_{M1} for structural steel	1.10	$\gamma_{Mf,s}$ for fatigue strength of studs in shear	1.00

1.2 Material Information

■ **Structural steel**

f_{sk} = 355.000 MPa E_s = 210000.000 MPa

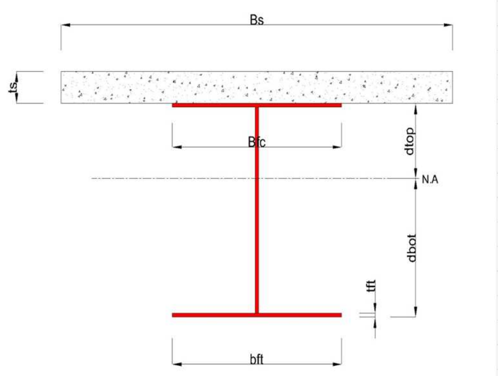
■ **Concrete**

f_{ck} = 28.000 MPa E_{cm} = 32000.000 MPa

■ **Reinforcement**

f_{yk} = 450.000 MPa E_r = 210000.000 MPa

1.3 Sectional Information



■ **Section Dimensions**

Slab

B_c	3647.000	mm	t_c	250.000	mm	H_h	0.000	mm

Girder

H_w	840.000	mm	B_1	500.000	mm	B_2	500.000	mm
t_w	16.000	mm	t_{f1}	25.000	mm	t_{f2}	35.000	mm

■ **Section Stiffness**

Before

A_a	43440.000	mm^2
$I_{y,a}$	6363981944.751	mm^4
$I_{z,a}$	625286720.000	mm^4
$C_{y,a}$	250.000	mm
$C_{z,a}$	403.204	mm

After

A_c	183710.526	mm^2
$I_{y,c}$	19918379045.200	mm^4
$I_{z,c}$	156098904627.114	mm^4
$C_{y,c}$	250.000	mm
$C_{z,c}$	877.971	mm

Crack

A_c	49092.000	mm^2
$I_{y,c}$	8567358844.978	mm^4
$I_{z,c}$	4245960641.044	mm^4
$C_{y,c}$	250.000	mm
$C_{z,c}$	478.822	mm

2 Bending Resistance

2.1 Positive Moment

■ Design load

Load combination name : LCB15

$N_{a,Ed}$	0.000	kN
$N_{c,Ed}$	938.887	kN
$M_{a,Ed}$	0.000	kN・m
$M_{c,Ed}$	587.694	kN・m

- Stress

Top Flange

Left	y_1	-250.000	mm	z_1	22.029	mm	σ_1	6.182 MPa
	y_2	-8.000	mm	z_2	22.029	mm	σ_2	4.516 MPa
Right	y_1	250.000	mm	z_1	22.029	mm	σ_1	2.739 MPa
	y_2	8.000	mm	z_2	22.029	mm	σ_2	4.406 MPa

Bottom Flange

Left	y_1	-250.000	mm	z_1	-877.971	mm	σ_1	32.737 MPa
	y_2	-8.000	mm	z_2	-877.971	mm	σ_2	31.070 MPa
Right	y_1	250.000	mm	z_1	-877.971	mm	σ_1	29.294 MPa
	y_2	8.000	mm	z_2	-877.971	mm	σ_2	30.960 MPa

Web

Right	y_1	0.000	mm	z_1	-2.971	mm	σ_1	5.198 MPa
	y_2	0.000	mm	z_2	-842.971	mm	σ_2	29.983 MPa

■ Classification of sections

Part	Class
Top flange	1
Web	1
Bottom flange	1
Section	1

- Plastic resistance moment, $M_{pl,Rd}$

Plastic NA = 897.311 mm

N_{slab} = 14466.433 kN

$N_{g,top}$ = 477.383 kN (Upper side of PNA)

$N_{g,bot}$ = 14943.817 kN (Lower side of PNA)

$M_{pl,Rd}$ = 9468.204 kN・m

x_{pl} = 252.689 mm

M_{Rd} = $\beta M_{pl,Rd}$ = 9468.204 kN・m

here, β = 1.000

M_{Rd} = 9468.204 kN・m > M_{Ed} = 587.694 kN・m ...OK

2 Bending Resistance

2.2 Negative Moment

■ Design load

Load combination name : LCB15

$N_{a,Ed}$	0.000	kN
$N_{c,Ed}$	-654.005	kN
$M_{a,Ed}$	0.000	kN・m
$M_{c,Ed}$	-959.590	kN・m

- Stress

Top Flange

Left	y_1	-250.000	mm	z_1	421.178	mm	σ_1	-31.298	MPa
	y_2	-8.000	mm	z_2	421.178	mm	σ_2	31.767	MPa
Right	y_1	250.000	mm	z_1	421.178	mm	σ_1	99.003	MPa
	y_2	8.000	mm	z_2	421.178	mm	σ_2	35.937	MPa

Bottom Flange

Left	y_1	-250.000	mm	z_1	-478.822	mm	σ_1	-132.103	MPa
	y_2	-8.000	mm	z_2	-478.822	mm	σ_2	-69.037	MPa
Right	y_1	250.000	mm	z_1	-478.822	mm	σ_1	-1.802	MPa
	y_2	8.000	mm	z_2	-478.822	mm	σ_2	-64.868	MPa

Web

Right	y_1	0.000	mm	z_1	396.178	mm	σ_1	31.052	MPa
	y_2	0.000	mm	z_2	-443.822	mm	σ_2	-63.032	MPa

■ Classification of sections

Part	Class
Top flange	1
Web	1
Bottom flange	1
Section	1

- Plastic resistance moment, $M_{pl,Rd}$

Plastic NA = 493.438 mm

N_{slab} = 0.000 kN

N_{rebar} = 2211.652 kN

$N_{g,top}$ = 6604.774 kN (Upper side of PNA)

$N_{g,bot}$ = 8816.426 kN (Lower side of PNA)

$M_{pl,Rd}$ = 6968.797 kN・m

M_{Rd} = $M_{pl,Rd}$ = 6968.797 kN・m

M_{Rd} = 6968.797 kN・m > M_{Ed} = -959.590 kN・m …OK

3 **Resistance to Vertical Shear**

■ Design load

Load combination name : LCB15

N_{Ed}	=	-654.005	kN
$M_{a,Ed}$	=	0.000	kN・m
$M_{c,Ed}$	=	-959.590	kN・m
$V_{Ed,a}$	=	0.000	kN
$V_{Ed,c}$	=	-1150.049	kN
V_{Ed}	=	-1150.049	kN

- Stress

Top Flange

Left	y_1	-250.000	mm	z_1	421.178	mm	σ_1	-31.298	MPa
	y_2	-8.000	mm	z_2	421.178	mm	σ_2	31.767	MPa
Right	y_1	250.000	mm	z_1	421.178	mm	σ_1	99.003	MPa
	y_2	8.000	mm	z_2	421.178	mm	σ_2	35.937	MPa

Bottom Flange

Left	y_1	-250.000	mm	z_1	-478.822	mm	σ_1	-132.103	MPa
	y_2	-8.000	mm	z_2	-478.822	mm	σ_2	-69.037	MPa
Right	y_1	250.000	mm	z_1	-478.822	mm	σ_1	-1.802	MPa
	y_2	8.000	mm	z_2	-478.822	mm	σ_2	-64.868	MPa

Web

Right	y_1	0.000	mm	z_1	396.178	mm	σ_1	31.052	MPa
	y_2	0.000	mm	z_2	-443.822	mm	σ_2	-63.032	MPa

■ Classification of sections

Part	Class
Top flange	1
Web	1
Bottom flange	1
Section	1

■ Plastic resistance moment, $M_{pl,Rd}$

Plastic NA = 493.438 mm

N_{slab}	=	0.000	kN
$N_{g,top}$	=	6604.774	kN
$N_{g,bot}$	=	8816.426	kN

$M_{pl,Rd}$	=	6968.797	kN・m

■ Calculation. $V_{bw,Rd}$

Web

■ Contribution from the web

$\lambda_w = h_w / (86.4 \cdot t \cdot \varepsilon) = 0.747$

$X_w = 0.83 / \lambda_w = 1.111$ $\quad 0.83/\eta \leq \lambda_w < 1.08$

$$V_{bw,Rd} = \frac{X_w \cdot f_{yw} \cdot h_w \cdot t}{\sqrt{3} \cdot \gamma_{M1}} = 2783.086 \text{ kN}$$

$V_{Rd} = 2783.086$ kN

$V_{Edi} = V_{Ed}$ / Num. of Web $= -1150.049$ kN

$\eta'_3 = V_{Edi} / V_{bw,Rd} = 0.413 \leq 1.0$

■ Contribution from the flange

$M_{f,Rd0} = 5791.574$ kN・m

$M_{f,Rd0}$ is calculated as $M_{pl,Rd}$ but neglecting the web contribution.

$$\text{Reduction factor for } N_{Ed} = 1 - \frac{N_{Ed}}{(A_{f1}+A_{f2}) \cdot f_{yf}/\gamma_{M0}} = 0.939$$

$M_{f,Rd}$ = Reduction factor for $N_{Ed} \cdot M_{f,Rd0} = 5435.920$ kN・m

$$V_{bf,Rd} = \frac{b_f \cdot t_f^2 \cdot f_{yf}}{c \cdot \gamma_{M1}} \left(1 - \left(\frac{M_{Ed}}{M_{f,Rd}}\right)^2\right) = 0.000 \text{ kN}$$

where, $M_{f,Rd} = 5435.920$ kN・m

$M_{Ed} = 1023.287$ kN・m (Taken as the greatest value of $(\sum\sigma_i)W$)

$$c = a \cdot \left(0.25 + \frac{1.6 \cdot b_f \cdot t_f^2 \cdot f_{yf}}{t \cdot h_w^2 \cdot f_{yw}}\right) = 0.000$$

■ Check Shear Resistance

$V_{Edi} / (V_{bw,Rd}+V_{bf,Rd}) = 0.413 < 1.0$ … OK

■ Interaction M-V

For the section class 1 or 2, M-V interaction should be checked separately by the user.

4 Resistance to Lateral Torsional Buckling

- Design load

Load combination name : LCB15

N_{Ed}	=	-654.005	kN
M_{Ed}	=	-959.590	kN · m
V_1	=	-1150.049	kN
V_2	=	-257.410	kN
M_1	=	-959.590	kN · m
M_2	=	1259.788	kN · m
$M_{pl,Rd}$	=	6968.797	kN · m
$M_{el,Rd}$	=	4994.865	kN · m

- $M_{b,Rd}$ Buckling resistance moment

L	=	7.250	m		
c	=	C_d / I	=	0.000	
γ	=	$c \cdot L^4 / (E \cdot I)$	=	0.000	
μ	=	V_2 / V_1	=	0.224	
Φ	=	$2 \cdot (1-M_2/M_1) / (1+\mu)$	=	1.634	
m_1	=	$1+0.44 \cdot (1+\mu) \cdot \Phi^{1.5}+(3+2 \cdot \Phi) \cdot \gamma/(350-50 \cdot \mu)$	=	2.125	
m_2	=	$1+0.44 \cdot (1+\mu) \cdot \Phi^{1.5}+(0.195+(0.05+\mu/100) \cdot \Phi) \cdot \gamma^{0.5}$	=	2.125	
m	=	$Min(m_1, m_2)$	=	2.125	
α_{LT}	=	0.490			
λ_{LT}	=	$1.103 \cdot L/b \cdot \sqrt{(f_y/Em)} \cdot \sqrt{(1+A_{wc}/(3 \cdot A_f)}$	=	0.481	
Φ_{LT}	=	$0.5 \cdot (1+\alpha_{LT} \cdot (\lambda_{LT} - 0.2)+\lambda_{LT}^2)$	=	0.684	
X_{LT}	=	$\dfrac{1}{\Phi_{LT} + \sqrt{(\Phi_{LT}^2 - \lambda_{LT}^2)}}$	=	0.853752999	
M_{Rd}	=	6968.797	kN · m		
$M_{b,Rd}$	=	$X_{LT} \cdot M_{Rd}$	=	5949.631	kN · m

- $N_{b,Rd}$ Axial buckling resistance

$X_{LT,N}$	=	0.702			
$N_{b,Rd}$	=	$X_{LT} \cdot Area \cdot f_{yd}$	=	12228.895	kN

Combined Ratio $= \dfrac{N_{Ed}}{N_{b,Rd}} + \dfrac{M_{Ed}}{M_{b,Rd}} =$ 0.214765914

6	**Resistance to Longitudinal Shear**				
	- Design load				
	Load combination name :	LCB15			
	$N_{c,el}$	=	0.000	kN	
	$N_{c,f}$	=	0.000	kN	
	M_{Ed}	=	-959.590	kN · m	
	V_{Ed}	=	-1150.049	kN	
	$M_{pl,Rd}$	=	6968.797	kN · m	
	$M_{el,Rd}$	=	4994.865	kN · m	
	- Shear resistance of a single connector				
	$P_{Rd,1}$	=	$0.8 \cdot f_u \cdot \pi \cdot d^2 / 4 / \gamma_V$	=	9047.787 kN
	$P_{Rd,2}$	=	$0.29 \cdot \alpha \cdot d^2 \cdot \sqrt{(f_{ck} \cdot E_{cm})} / \gamma_V$	=	3074.468 kN
	P_{Rd}	=	$\mathrm{Min}(P_{Rd,1}, P_{Rd,2})$	=	3074.468 kN
	where, f_u	=	450.000	MPa	
	α	=	$0.2 \cdot (h_{sc}/d + 1)$	=	0.350
	Num.	=	2		
	d	=	200.000	mm	
	h_{sc}	=	150.000	mm	
	Space	=	300.000	mm	
	- Verification				
	$v_{L,Ed}$	=	$V_{Ed} \cdot (A \cdot z / I)$	=	1179.430 kN/m
	$v_{L,Rd}$	=	$P_{Rd} \cdot$ Num./Space	=	20496.456 kN/m
	$v_{L,Ed}$	<	$v_{L,Rd}$	…	OK

7 **Resistance to Fatigue**

- Design load

Load combination name : sLCB1

F_z = -996.845 kN

- Shear stress range for the connector

$\Delta\tau = F_{sc} / A_{sc}$ = 4.881 MPa

where, F_{sc} = $v_{L,Ed} \cdot$ space of stud / number of stud = 153.347 kN

A_{sc} = 31415.927 mm^2

- Damage equivalent factor

$\lambda_v = \lambda_{v,1} \cdot \lambda_{v,2} \cdot \lambda_{v,3} \cdot \lambda_{v,4}$ = 0.000

where, $\lambda_{v,1}$ = 1.550

$\lambda_{v,2}$ = 0.000

$\lambda_{v,3}$ = 1.000

$\lambda_{v,4}$ = 0.000

- Equivalent constant amplitude range of shear stress related to 2 million cycles

$\Delta\tau_{E,2} = \lambda_v \cdot \Delta\tau$ = 0.000 MPa

- Verification

$\gamma_{Ff} \cdot \Delta\tau_{E,2} / (\Delta\tau_c / \gamma_{Mf,s})$ = 0.000 < 1

0 **Longitudinal Shear for SLS(Serviceability limit state)**

- Shear resistance of a single connector

Load combination name : sLCB4

$P_{Rd,1} = 0.8 \cdot f_u \cdot \pi \cdot d^2 / 4 / \gamma_V$ = 9047.787 kN

$P_{Rd,2} = 0.29 \cdot \alpha \cdot d^2 \cdot \sqrt{(f_{ck} \cdot E_{cm})} / \gamma_V$ = 3074.468 kN

$P_{Rd} = Min(P_{Rd,1}, P_{Rd,2})$ = 3074.468 kN

$P_{Rd,ser} = k_s \cdot P_{Rd}$ = 2305.851 kN

where, f_u = 450.000 MPa

$\alpha = 0.2 \cdot (h_{sc}/d + 1)$ = 0.350

Num. = 2

d = 200.000 mm

h_{sc} = 150.000 mm

Space = 300.000 mm

k_s = 0.750

- Verification

$v_{L,Ed} = V_{Ed} \cdot (A \cdot z / I)$ = 334.959 kN/m

$v_{L,Rd} = P_{Rd,ser} \cdot$ Num./Space = 15372.342 kN/m

$v_{L,Ed} < v_{L,Rd}$ … OK

TRAVERSI SPALLE

Element Number	39
Position Information	I

1 Design Condition

1.1 Design Parameters

■ Partial factors

γ_C for concrete	1.50	γ_V for headed sutd	1.25
γ_S for reinforcing steel	1.15	γ_{Ff} for equivalent constant Amplitude stress range	1.00
γ_{M0} for structural steel	1.00	γ_{Mf} for fatigue strength	1.00
γ_{M1} for structural steel	1.10	$\gamma_{Mf,s}$ for fatigue strength of studs in shear	1.00

1.2 Material Information

■ Structural steel

f_{sk} = 355.000 MPa E_s = 210000.000 MPa

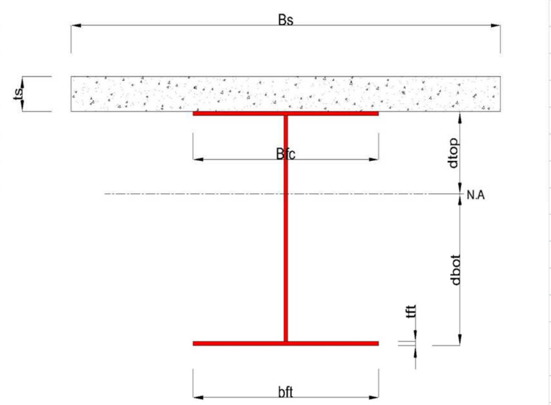
■ Concrete

f_{ck} = 28.000 MPa E_{cm} = 32000.000 MPa

■ Reinforcement

f_{yk} = 450.000 MPa E_r = 210000.000 MPa

1.3 Sectional Information



■ Section Dimensions

Slab

B_c	2423.500	mm	t_c	250.000	mm	H_h	0.000	mm

Girder

H_w	820.000	mm	B_1	500.000	mm	B_2	500.000	mm
t_w	20.000	mm	t_{f1}	40.000	mm	t_{f2}	40.000	mm

■ Section Stiffness

Before

A_a	56400.000	mm^2
$I_{y,a}$	8320280000.000	mm^4
$I_{z,a}$	833880000.000	mm^4
$C_{y,a}$	250.000	mm
$C_{z,a}$	450.000	mm

After

A_c	149612.399	mm^2
$I_{y,c}$	20423480885.424	mm^4
$I_{z,c}$	46456317725.948	mm^4
$C_{y,c}$	250.000	mm
$C_{z,c}$	808.240	mm

Crack

A_c	60796.000	mm^2
$I_{y,c}$	9682021293.985	mm^4
$I_{z,c}$	3381144189.983	mm^4
$C_{y,c}$	250.000	mm
$C_{z,c}$	491.577	mm

2 Bending Resistance

2.1 Positive Moment

■ Design load

Load combination name : LCB15

$N_{a,Ed}$	0.000	kN
$N_{c,Ed}$	-64.787	kN
$M_{a,Ed}$	0.000	kN・m
$M_{c,Ed}$	492.770	kN・m

- Stress

Top Flange

Left	y_1	-250.000	mm	z_1	91.760	mm	σ_1	-0.722	MPa
	y_2	-10.000	mm	z_2	91.760	mm	σ_2	-2.570	MPa
Right	y_1	250.000	mm	z_1	91.760	mm	σ_1	-4.572	MPa
	y_2	10.000	mm	z_2	91.760	mm	σ_2	-2.724	MPa

Bottom Flange

Left	y_1	-250.000	mm	z_1	-808.240	mm	σ_1	20.993	MPa
	y_2	-10.000	mm	z_2	-808.240	mm	σ_2	19.145	MPa
Right	y_1	250.000	mm	z_1	-808.240	mm	σ_1	17.142	MPa
	y_2	10.000	mm	z_2	-808.240	mm	σ_2	18.991	MPa

Web

Right	y_1	0.000	mm	z_1	51.760	mm	σ_1	-1.682	MPa
	y_2	0.000	mm	z_2	-768.240	mm	σ_2	18.103	MPa

■ Classification of sections

Part	Class
Top flange	1
Web	1
Bottom flange	1
Section	1

- Plastic resistance moment, $M_{pl,Rd}$

Plastic NA = 870.679 mm

N_{slab} = 9613.217 kN

$N_{g,top}$ = 5204.392 kN (Upper side of PNA)

$N_{g,bot}$ = 14817.608 kN (Lower side of PNA)

$M_{pl,Rd}$ = 10058.957 kN・m

x_{pl} = 279.321 mm

M_{Rd} = $\beta M_{pl,Rd}$ = 10058.957 kN・m

here, β = 1.000

M_{Rd} = 10058.957 kN・m > M_{Ed} = 492.770 kN・m ...OK

2 **Bending Resistance**

2.2 Negative Moment

■ Design load

Load combination name : LCB15

$N_{a,Ed}$	0.000	kN
$N_{c,Ed}$	-1539.636	kN
$M_{a,Ed}$	0.000	kN・m
$M_{c,Ed}$	-683.310	kN・m

- Stress

Top Flange

Left	y_1	-250.000	mm	z_1	408.423	mm	σ_1	-40.511	MPa
	y_2	-10.000	mm	z_2	408.423	mm	σ_2	1.739	MPa
Right	y_1	250.000	mm	z_1	408.423	mm	σ_1	47.511	MPa
	y_2	10.000	mm	z_2	408.423	mm	σ_2	5.260	MPa

Bottom Flange

Left	y_1	-250.000	mm	z_1	-491.577	mm	σ_1	-104.029	MPa
	y_2	-10.000	mm	z_2	-491.577	mm	σ_2	-61.778	MPa
Right	y_1	250.000	mm	z_1	-491.577	mm	σ_1	-16.007	MPa
	y_2	10.000	mm	z_2	-491.577	mm	σ_2	-58.257	MPa

Web

Right	y_1	0.000	mm	z_1	368.423	mm	σ_1	0.677	MPa
	y_2	0.000	mm	z_2	-451.577	mm	σ_2	-57.195	MPa

■ Classification of sections

Part	Class
Top flange	3
Web	1
Bottom flange	1
Section	3

- Elastic resistance moment, $M_{el,Rd}$

k = 9.423 : the lowest factor such that a stress limit is reached.

(Calculate minimum value between Steel Girder and Slab Reinforcement.)

$M_{el,Rd} = M_{a,Ed} + k \cdot M_{c,Ed}$ = 6438.593 kN・m

$M_{Rd} = M_{el,Rd}$ = 6438.593 kN・m

M_{Rd} = 6438.593 kN・m > M_{Ed} = -683.310 kN・m …OK

3 Resistance to Vertical Shear

■ Design load

Load combination name : LCB15

N_{Ed}	=	-1539.636	kN
$M_{a,Ed}$	=	0.000	kN・m
$M_{c,Ed}$	=	-683.310	kN・m
$V_{Ed,a}$	=	0.000	kN
$V_{Ed,c}$	=	-1060.042	kN
V_{Ed}	=	-1060.042	kN

- Stress

Top Flange

Left	y_1	-250.000	mm	z_1	408.423	mm	σ_1	-40.511	MPa
	y_2	-10.000	mm	z_2	408.423	mm	σ_2	1.739	MPa
Right	y_1	250.000	mm	z_1	408.423	mm	σ_1	47.511	MPa
	y_2	10.000	mm	z_2	408.423	mm	σ_2	5.260	MPa

Bottom Flange

Left	y_1	-250.000	mm	z_1	-491.577	mm	σ_1	-104.029	MPa
	y_2	-10.000	mm	z_2	-491.577	mm	σ_2	-61.778	MPa
Right	y_1	250.000	mm	z_1	-491.577	mm	σ_1	-16.007	MPa
	y_2	10.000	mm	z_2	-491.577	mm	σ_2	-58.257	MPa

Web

Right	y_1	0.000	mm	z_1	368.423	mm	σ_1	0.677	MPa
	y_2	0.000	mm	z_2	-451.577	mm	σ_2	-57.195	MPa

■ Classification of sections

Part	Class
Top flange	3
Web	1
Bottom flange	1
Section	3

■ Plastic resistance moment, $M_{pl,Rd}$

Plastic NA = 571.139 mm

N_{slab}	=	0.000	kN
$N_{g,top}$	=	9150.913	kN
$N_{g,bot}$	=	10871.087	kN
$M_{pl,Rd}$	=	8184.420	kN・m

■ Calculation. $V_{bw,Rd}$

Web

■ Contribution from the web

$\lambda_w = h_w / (86.4 \cdot t \cdot \varepsilon) = 0.583$

$X_w = \eta = 1.200$ $\lambda_w < 0.83/\eta$

$$V_{bw,Rd} = \frac{X_w \cdot f_{yw} \cdot h_w \cdot t}{\sqrt{3} \cdot \gamma_{M1}} = 3666.909 \text{ kN}$$

$V_{Rd} = 3666.909$ kN

$V_{Edi} = V_{Ed}$ / Num. of Web $= -1060.042$ kN

$\eta'_3 = V_{Edi} / V_{bw,Rd} = 0.289 \leq 1.0$

■ Contribution from the flange

$M_{f,Rd0} = 6385.661$ kN・m

$M_{f,Rd0}$ is calculated as $M_{pl,Rd}$ but neglecting the web contribution.

$$\text{Reduction factor for } N_{Ed} = 1 - \frac{N_{Ed}}{(A_{f1}+A_{f2}) \cdot f_{yf}/\gamma_{M0}} = 0.892$$

$M_{f,Rd}$ = Reduction factor for $N_{Ed} \cdot M_{f,Rd0} = 5693.295$ kN・m

$$V_{bf,Rd} = \frac{b_f \cdot t_f^2 \cdot f_{yf}}{c \cdot \gamma_{M1}} \left(1 - \left(\frac{M_{Ed}}{M_{f,Rd}}\right)^2\right) = 0.000 \text{ kN}$$

where, $M_{f,Rd} = 5693.295$ kN・m

$M_{Ed} = 885.996$ kN・m (Taken as the greatest value of $(\sum\sigma_i)W$)

$$c = a \cdot \left(0.25 + \frac{1.6 \cdot b_f \cdot t_f^2 \cdot f_{yf}}{t \cdot h_w^2 \cdot f_{yw}}\right) = 0.000$$

■ Check Shear Resistance

$V_{Edi} / (V_{bw,Rd} + V_{bf,Rd}) = 0.289 < 1.0$ … OK

■ Interaction M-V

$\eta'_3 = 0.289 < 0.5$

There is no need to verify the interaction criterion

4 Resistance to Lateral Torsional Buckling

- Design load

Load combination name :		LCB15	
N_{Ed}	=	-1539.636	kN
M_{Ed}	=	-683.310	kN · m
V_1	=	-1060.042	kN
V_2	=	-260.949	kN
M_1	=	-683.310	kN · m
M_2	=	728.896	kN · m
$M_{pl,Rd}$	=	8184.420	kN · m
$M_{el,Rd}$	=	6438.593	kN · m

- $M_{b,Rd}$ Buckling resistance moment

L	=	7.250	m		
c	=	C_d / I	=	0.000	
γ	=	$c \cdot L^4 / (E \cdot I)$	=	0.000	
μ	=	V_2 / V_1	=	0.246	
Φ	=	$2 \cdot (1-M_2/M_1) / (1+\mu)$	=	1.605	
m_1	=	$1+0.44 \cdot (1+\mu) \cdot \Phi^{1.5}+(3+2 \cdot \Phi) \cdot \gamma/(350-50 \cdot \mu)$	=	2.115	
m_2	=	$1+0.44 \cdot (1+\mu) \cdot \Phi^{1.5}+(0.195+(0.05+\mu/100) \cdot \Phi) \cdot \gamma^{0.5}$	=	2.115	
m	=	$Min(m_1, m_2)$	=	2.115	
α_{LT}	=	0.490			
λ_{LT}	=	$1.103 \cdot L/b \cdot \sqrt{(f_y/Em)} \cdot \sqrt{(1+A_{wc}/(3 \cdot A_f)}$	=	0.485	
Φ_{LT}	=	$0.5 \cdot (1+\alpha_{LT} \cdot (\lambda_{LT} - 0.2)+\lambda_{LT}^2)$	=	0.687	
X_{LT}	=	$\dfrac{1}{\Phi_{LT} + \sqrt{(\Phi_{LT}^2 - \lambda_{LT}^2)}}$	=	0.851330014	
M_{Rd}	=	6438.593	kN · m		
$M_{b,Rd}$	=	$X_{LT} \cdot M_{Rd}$	=	5481.367	kN · m

- $N_{b,Rd}$ Axial buckling resistance

$X_{LT,N}$	=	0.699			
$N_{b,Rd}$	=	$X_{LT} \cdot Area \cdot f_{yd}$	=	15076.006	kN

Combined Ratio $= \dfrac{N_{Ed}}{N_{b,Rd}} + \dfrac{M_{Ed}}{M_{b,Rd}} =$ 0.226785349

4 **Resistance to Lateral Torsional Buckling**

- Design load

Load combination name : LCB15

N_{Ed}	=	-1539.636	kN
M_{Ed}	=	-683.310	kN · m
V_1	=	-1060.042	kN
V_2	=	-260.949	kN
M_1	=	-683.310	kN · m
M_2	=	728.896	kN · m
$M_{pl,Rd}$	=	8184.420	kN · m
$M_{el,Rd}$	=	6438.593	kN · m

- $M_{b,Rd}$ Buckling resistance moment

L	=	7.250	m		
c	=	C_d / I	=	0.000	
γ	=	$c \cdot L^4 / (E \cdot I)$	=	0.000	
μ	=	V_2 / V_1	=	0.246	
Φ	=	$2 \cdot (1-M_2/M_1) / (1+\mu)$	=	1.605	
m_1	=	$1+0.44 \cdot (1+\mu) \cdot \Phi^{1.5}+(3+2 \cdot \Phi) \cdot \gamma/(350-50 \cdot \mu)$	=	2.115	
m_2	=	$1+0.44 \cdot (1+\mu) \cdot \Phi^{1.5}+(0.195+(0.05+\mu/100) \cdot \Phi) \cdot \gamma^{0.5}$	=	2.115	
m	=	$\mathrm{Min}(m_1, m_2)$	=	2.115	
α_{LT}	=	0.490			
λ_{LT}	=	$1.103 \cdot L/b \cdot \sqrt{(f_y/Em)} \cdot \sqrt{(1+A_{wc}/(3 \cdot A_f))}$	=	0.485	
Φ_{LT}	=	$0.5 \cdot (1+\alpha_{LT} \cdot (\lambda_{LT} - 0.2)+\lambda_{LT}^2)$	=	0.687	
X_{LT}	=	$\dfrac{1}{\Phi_{LT} + \sqrt{(\Phi_{LT}^2 - \lambda_{LT}^2)}}$	=	0.851330014	
M_{Rd}	=	6438.593	kN · m		
$M_{b,Rd}$	=	$X_{LT} \cdot M_{Rd}$	=	5481.367	kN · m

- $N_{b,Rd}$ Axial buckling resistance

$X_{LT,N}$	=	0.699			
$N_{b,Rd}$	=	$X_{LT} \cdot Area \cdot f_{yd}$	=	15076.006	kN

Combined Ratio $= \dfrac{N_{Ed}}{N_{b,Rd}} + \dfrac{M_{Ed}}{M_{b,Rd}} =$ 0.226785349

7	**Resistance to Fatigue**				
	- Design load				
	Load combination name :	sLCB1			
	F_z	=	-277.792	kN	
	- Shear stress range for the connector				
	$\Delta\tau$ = F_{sc} / A_{sc}	=	1.300	MPa	
	where, F_{sc}	=	$v_{L,Ed}$ • space of stud / number of stud	=	40.830 kN
	A_{sc}	=	31415.927	mm^2	
	- Damage equivalent factor				
	λ_v = $\lambda_{v,1}$ • $\lambda_{v,2}$ • $\lambda_{v,3}$ • $\lambda_{v,4}$	=	0.000		
	where, $\lambda_{v,1}$	=	1.550		
	$\lambda_{v,2}$	=	0.000		
	$\lambda_{v,3}$	=	1.000		
	$\lambda_{v,4}$	=	0.000		
	- Equivalent constant amplitude range of shear stress related to 2 million cycles				
	$\Delta\tau_{E,2}$ = λ_v • $\Delta\tau$	=	0.000	MPa	
	- Verification				
	γ_{Ff} • $\Delta\tau_{E,2}$ / ($\Delta\tau_c$ / $\gamma_{Mf,s}$)	=	0.000	<	1
0	**Longitudinal Shear for SLS(Serviceability limit state)**				
	- Shear resistance of a single connector				
	Load combination name :	sLCB4			
	$P_{Rd,1}$ = 0.8 • f_u • π • d^2 / 4 / γ_V	=	9047.787	kN	
	$P_{Rd,2}$ = 0.29 • α • d^2 • √(f_{ck} • E_{cm}) / γ_V	=	3074.468	kN	
	P_{Rd} = Min($P_{Rd,1}$, $P_{Rd,2}$)	=	3074.468	kN	
	$P_{Rd,ser}$ = k_s • P_{Rd}	=	2305.851	kN	
	where, f_u	=	450.000	MPa	
	α = 0.2 • (h_{sc}/d +1)	=	0.350		
	Num.	=	2		
	d	=	200.000	mm	
	h_{sc}	=	150.000	mm	
	Space	=	300.000	mm	
	k_s	=	0.750		
	- Verification				
	$v_{L,Ed}$ = V_{Ed} • (A • z / I)	=	493.544	kN/m	
	$v_{L,Rd}$ = $P_{Rd,ser}$ • Num./Space	=	15372.342	kN/m	
	$v_{L,Ed}$ < $v_{L,Rd}$	…	OK		

Di seguito si riportano le seguenti verifiche:

- Momento resistente - SLU
- Resistenza al taglio verticale – SLU
- Resistenza all'instabilità laterale-torsionale – SLU
- Resistenza la taglio longitudinale (pioli) – SLU e SLE
- Tensioni massime nella sezione mista – SLE
- Resistenza la taglio longitudinale (pioli) – SLE

6.6.6. Verifica momento resistente - SLU

Si riportano i valori di calcolo del momento resistente della sezione mista per ogni concio di calcolo (elemento del modello).

Leggenda tabelle

Elem	*Elemento del modello*	Ma,Ed	*Momento flettente sezione di acciaio*
Position	*Posizione: I iniziale - J finale*	Mc,Ed	*Momento sollecitante sezione di cls*
+/-	*Verso del momento flettente*	Mpl,Rd	*Momento plastico resistente*
Lcom	*Combinazione di verifica*	Mel,Rd	*Momento elastico resistente*
Top Class	*Classificazione. piattabanda superiore*	M_Rd	*Momento resistente finale*
Bot Class	*Classificazione piattabanda inferiore*		
Web Class	*Classificazione anima*		
Sect. Class	*Classificazione sezione*		

Elem	part	Positive/Negative	Lcom	Type	Top Class	Bot Class	Web Class	Sect. Class	Ma,Ed (kN*m)	Mc,Ed (kN*m)	Mpl,Rd (kN*m)	Mel,Rd (kN*m)	M_Rd (kN*m)
39	I[2]	Neg	LCB15	FX-MIN	3	1	1	3	0.0000	-683.3096	8184.4197	6438.5928	6438.5928
39	I[2]	Pos	LCB15	FX-MAX	1	1	1	1	0.0000	492.7697	10058.9566	7320.5630	10058.9566
39	J[41]	Neg	-	-	-	-	-	-	-	-	-	-	-
39	J[41]	Pos	LCB15	FX-MAX	1	1	1	1	0.0000	3938.1273	10058.9566	7320.5630	10058.9566
47	I[10]	Neg	LCB15	FX-MIN	1	1	1	1	0.0000	-959.5899	6968.7970	4994.8654	6968.7970
47	I[10]	Pos	LCB15	FX-MAX	1	1	1	1	0.0000	587.6936	9468.2043	8053.8260	9468.2043
47	J[49]	Neg	-	-	-	-	-	-	-	-	-	-	-
47	J[49]	Pos	LCB15	FX-MAX	1	1	1	1	0.0000	3888.4711	9468.2043	8053.8260	9468.2043
48	I[11]	Neg	LCB15	FX-MIN	1	1	1	1	0.0000	-959.5895	6968.7970	4994.8654	6968.7970
48	I[11]	Pos	LCB15	FX-MAX	1	1	1	1	0.0000	587.7552	9468.2043	8053.8260	9468.2043
48	J[50]	Neg	-	-	-	-	-	-	-	-	-	-	-
48	J[50]	Pos	LCB15	FX-MAX	1	1	1	1	0.0000	3888.4679	9468.2043	8053.8260	9468.2043
57	I[41]	Neg	-	-	-	-	-	-	-	-	-	-	-
57	I[41]	Pos	LCB15	FX-MAX	1	1	1	1	0.0000	3949.2537	10058.9566	7320.5630	10058.9566
57	J[22]	Neg	LCB15	FX-MIN	1	1	1	1	0.0000	-394.2649	8184.4197	6438.5928	8184.4197
57	J[22]	Pos	LCB15	FX-MAX	1	1	1	1	0.0000	318.0308	10058.9566	7320.5630	10058.9566
65	I[49]	Neg	-	-	-	-	-	-	-	-	-	-	-
65	I[49]	Pos	LCB15	FX-MAX	1	1	1	1	0.0000	3888.4713	9468.2043	8053.8260	9468.2043
65	J[30]	Neg	LCB15	FX-MIN	1	1	1	1	0.0000	-962.2787	6968.7970	4994.8654	6968.7970
65	J[30]	Pos	LCB15	FX-MAX	1	1	1	1	0.0000	557.1564	9468.2043	8053.8260	9468.2043
66	I[50]	Neg	-	-	-	-	-	-	-	-	-	-	-
66	I[50]	Pos	LCB15	FX-MAX	1	1	1	1	0.0000	3888.4682	9468.2043	8053.8260	9468.2043
66	J[31]	Neg	LCB15	FX-MIN	1	1	1	1	0.0000	-962.2962	6968.7970	4994.8654	6968.7970
66	J[31]	Pos	LCB15	FX-MAX	1	1	1	1	0.0000	557.2200	9468.2043	8053.8260	9468.2043

6.6.7. Verifica taglio verticale (instabilità) - SLU

Si riportano i valori di calcolo del instabilità a taglio della sezione mista per ogni concio di calcolo (elemento del modello).

Leggenda tabelle

Elem	*Elemento del modello*	N_Ed	*Azione assiale sollecitante*
Position	*Posizione: I iniziale - J finale*	M_Ed	*Momento flettente sollecitante*
Lcom	*Combinazione di verifica*	V_Ed	*Azione di taglio sollecitante*
Top Class	*Classificazione. piattabanda superiore*	Vpl,Rd	*Azione di taglio plastico resistente*
Bot Class	*Classificazione piattabanda inferiore*	Vb,Rd	*Azione di taglio resistente finale*
Web Class	*Classificazione anima*		
Sect. Class	*Classificazione sezione*		

Elem	part	Lcom	Type	Top Class	Bot Class	Web Class	Sect. Class	N_Ed (kN)	M_Ed (kN*m)	V_Ed (kN)	Vpl,Rd (kN)	Vb,Rd (kN)
39	I[2]	LCB15	FX-MIN	3	1	1	3	-1539.6358	885.9963	-1060.0416	4033.5999	3666.9090
39	J[41]	LCB15	FX-MAX	1	1	1	1	-64.7868	4034.5089	353.4823	4033.5999	3666.9090
47	I[10]	LCB15	FX-MIN	1	1	1	1	-654.0050	1023.2871	-1150.0489	3305.5843	2783.0858
47	J[49]	LCB15	FX-MAX	1	1	1	1	938.8875	4004.4165	363.6376	3305.5843	2783.0858
48	I[11]	LCB15	FX-MIN	1	1	1	1	-654.0044	1023.2866	-1150.0413	3305.5843	2783.0858
48	J[50]	LCB15	FX-MAX	1	1	1	1	938.8891	4004.4135	363.6528	3305.5843	2783.0858
57	I[41]	LCB15	FX-MAX	1	1	1	1	-43.5950	4014.1090	356.6553	4033.5999	3666.9090
57	J[22]	LCB15	FX-MAX	1	1	1	1	-43.5950	382.8861	930.3589	4033.5999	3666.9090
65	I[49]	LCB15	FX-MAX	1	1	1	1	938.8875	4004.4167	364.8021	3305.5843	2783.0858
65	J[30]	LCB15	FX-MAX	1	1	1	1	938.8875	4063.8440	1035.3376	3305.5843	2783.0858
66	I[50]	LCB15	FX-MAX	1	1	1	1	938.8891	4004.4138	364.8172	3305.5843	2783.0858
66	J[31]	LCB15	FX-MAX	1	1	1	1	938.8891	4063.7883	1035.3363	3305.5843	2783.0858

6.6.8. Verifica all’instabilità laterale-torsionale - SLU

Si riportano i valori di calcolo del instabilità laterale-torsionale della sezione mista per ogni concio di calcolo (elemento del modello).

Leggenda tabelle

Elem	*Elemento del modello*	M_Ed	*Momento flettente sollecitante*
Position	*Posizione: I iniziale - J finale*	Nb_Rd	*Azione assiale resistente all’instabilità*
Lcom	*Combinazione di verifica*	Mb,Rd	*Momento flettente resistente all’instabilità*
Sect. Class	*Classificazione sezione*	Mcr	*Momento flettente critico*
N_Ed	*Azione assiale sollecitante*	Int. Ratio	Rapporto tra $N_{Ed}/N_{b,Rd} + M_{Ed}/M_{b,Rd}$

Elem	part	Lcom	Type	Sect. Class	N_Ed (kN)	M_Ed (kN*m)	Nb,Rd (kN)	Mb,Rd (kN*m)	Mcr (kN*m)	Interaction Ratio
39	I[2]	LCB15	FX-MIN	3	-1539.6358	-683.3096	15076.0059	5481.3673	0.0017	0.2268
39	J[41]	LCB15	FX-MAX	1	-64.7868	3938.1273	37100.4245	8507.0649	0.0021	0.4647
47	I[10]	LCB15	FX-MIN	1	-654.0050	-959.5899	12228.8951	5949.6313	14.7404	0.2148
47	J[49]	LCB15	FX-MAX	1	938.8875	3888.4711	48962.2904	7952.8886	21.1942	0.5081
48	I[11]	LCB15	FX-MIN	1	-654.0044	-959.5895	12228.8951	5949.6290	14.7405	0.2148
48	J[50]	LCB15	FX-MAX	1	938.8891	3888.4679	48962.2904	7952.8890	21.1939	0.5081
57	I[41]	LCB15	FX-MAX	1	-43.5950	3949.2537	37100.4245	8607.8440	0.0022	0.4600
57	J[22]	LCB15	FX-MIN	1	-1548.6474	-394.2649	15076.0059	6855.9781	0.0015	0.1602
65	I[49]	LCB15	FX-MAX	1	938.8875	3888.4713	48962.2904	8067.7773	21.2993	0.5012
65	J[30]	LCB15	FX-MIN	1	-654.0050	-962.2787	12228.8951	5868.2805	14.7543	0.2175
66	I[50]	LCB15	FX-MAX	1	938.8891	3888.4682	48962.2904	8067.7573	21.2991	0.5012
66	J[31]	LCB15	FX-MIN	1	-654.0044	-962.2962	12228.8951	5868.2717	14.7544	0.2175

6.6.9. Verifica al taglio longitudinale - SLU

Si riportano i valori di calcolo dei connetori della sezione mista per ogni concio di calcolo (elemento del modello).

Leggenda tabelle

Elem	*Elemento del modello*	v_L,Ed	*Taglio longitudinale sollecitante*
Position	*Posizione: I iniziale - J finale*	P_Rd	*Resistenza singolo connettore*
Lcom	*Combinazione di verifica*	v_L,Rd	*Taglio longitudinale resistente*
V_L,Ed	*Taglio longitudinale sollecitante*		

Elem	part	Lcom	Type	V_L,Ed (kN)	v_L,Ed (kN/m)	P_Rd (kN)	v_L,Rd (kN/m)
39	I[2]	LCB15	FX-MIN	-1060.0416	1038.6906	3074.4683	20496.4556
39	J[41]	LCB15	FX-MAX	353.4823	346.3626	3074.4683	20496.4556
47	I[10]	LCB15	FX-MIN	-1150.0489	1179.4300	3074.4683	20496.4556
47	J[49]	LCB15	FX-MAX	363.6376	372.9277	3074.4683	20496.4556
48	I[11]	LCB15	FX-MIN	-1150.0413	1179.4222	3074.4683	20496.4556
48	J[50]	LCB15	FX-MAX	363.6528	372.9433	3074.4683	20496.4556
57	I[41]	LCB15	FX-MAX	356.6553	349.4717	3074.4683	20496.4556
57	J[22]	LCB15	FX-MAX	930.3589	911.6199	3074.4683	20496.4556
65	I[49]	LCB15	FX-MAX	364.8021	374.1219	3074.4683	20496.4556
65	J[30]	LCB15	FX-MAX	1035.3376	1061.7881	3074.4683	20496.4556
66	I[50]	LCB15	FX-MAX	364.8172	374.1375	3074.4683	20496.4556
66	J[31]	LCB15	FX-MAX	1035.3363	1061.7868	3074.4683	20496.4556

6.6.10. Verifica delle tensioni - SLE

Si riportano i valori di calcolo delle tensioni della sezione mista per ogni concio di calcolo (elemento del modello).

Leggenda tabella delle tensioni sezione in acciaio - Top and Bottom of Structural Steel

Elem	*Elemento del modello*	Tau_Ed,ser	*Tensione tangenziale sollecitante*
Position	*Posizione: I iniziale - J finale*	SQRT…	*Tensione ideale*
Lcom	*Combinazione di verifica*	ALW	*Tensione limite*
Sigma_Ed,ser	*Tensione normale sollecitante*		

Elem	part	Top and Bottom Flange of Structural Steel							
		Lcom	Type	Sigma_Ed,ser (N/mm^2)	ALW (N/mm^2)	Tau_Ed,ser (N/mm^2)	ALW (N/mm^2)	SQRT(sigma^2+3tau^2) (N/mm^2)	ALW (N/mm^2)
39	I[2]	sLCB4	Characteristic	24.7127	355	30.7127	204.9593	58.6561	355
39	J[41]	sLCB4	Characteristic	-61.93	355	4.3437	204.9593	62.3853	355
47	I[10]	sLCB4	Characteristic	0.4591	355	24.3017	204.9593	42.0942	355
47	J[49]	sLCB4	Characteristic	-50.0777	355	0.7884	204.9593	50.0963	355
48	I[11]	sLCB4	Characteristic	0.5348	355	24.3008	204.9593	42.0935	355
48	J[50]	sLCB4	Characteristic	-50.0775	355	0.7893	204.9593	50.0962	355
57	I[41]	sLCB4	Characteristic	-61.3363	355	4.487	204.9593	61.8267	355
57	J[22]	sLCB4	Characteristic	7.4771	355	21.4606	204.9593	37.9154	355
65	I[49]	sLCB4	Characteristic	-50.0777	355	0.8526	204.9593	50.0994	355
65	J[30]	sLCB4	Characteristic	14.6232	355	22.7878	204.9593	42.0914	355
66	I[50]	sLCB4	Characteristic	-50.0775	355	0.8535	204.9593	50.0994	355
66	J[31]	sLCB4	Characteristic	9.9907	355	22.7887	204.9593	40.7159	355

Leggenda tabella delle tensioni soletta in C.A. – *Concrete Deck* e barre di armatura - *Reinforcement*

Elem	*Elemento del modello*	k*fck	*Tensione limite calcestruzzo*
Position	*Posizione: I iniziale - J finale*	Sigma_s	*Tensione normale sollecitante barre*
Lcom	*Combinazione di verifica*	k*fsk	*Tensione limite barre di acciaio*
Sigma_c	*Tensione normale sollecitante soletta*		

Elem	part	Concrete Deck				Reinforcement in Deck			
		Lcom	Type	Sigma_c (N/mm^2)	k*fck (N/mm^2)	Lcom	Type	Sigma_s (N/mm^2)	k*fsk (N/mm^2)
39	I[2]	sLCB4	Characteristic	0	16.8	sLCB9	Frequent	42.8301	360
39	J[41]	sLCB4	Characteristic	6.3449	16.8	sLCB4	Characteristic	-35.4284	360
47	I[10]	sLCB4	Characteristic	0.3216	16.8	sLCB9	Frequent	15.7411	360
47	J[49]	sLCB11	Quasi-Permanent	1.9741	12.6	sLCB4	Characteristic	-15.764	360
48	I[11]	sLCB4	Characteristic	0.4058	16.8	sLCB9	Frequent	15.5873	360
48	J[50]	sLCB11	Quasi-Permanent	1.9742	12.6	sLCB4	Characteristic	-15.764	360
57	I[41]	sLCB4	Characteristic	6.3284	16.8	sLCB4	Characteristic	-35.3631	360
57	J[22]	sLCB4	Characteristic	1.3356	16.8	sLCB9	Frequent	42.8706	360
65	I[49]	sLCB11	Quasi-Permanent	1.9741	12.6	sLCB4	Characteristic	-15.764	360
65	J[30]	sLCB4	Characteristic	0	16.8	sLCB4	Characteristic	90.5808	360
66	I[50]	sLCB11	Quasi-Permanent	1.9742	12.6	sLCB4	Characteristic	-15.764	360
66	J[31]	sLCB4	Characteristic	0	16.8	sLCB4	Characteristic	58.0592	360

6.6.11. Verifica al taglio longitudinale - SLE

Si riportano i valori di calcolo dei connettori della sezione mista per ogni concio di calcolo (elemento del modello).

Leggenda tabelle

Elem	*Elemento del modello*	v_L,Ed	*Taglio longitudinale sollecitante*
Position	*Posizione: I iniziale - J finale*	P_Rd	*Resistenza singolo connettore*
Lcom	*Combinazione di verifica*	v_L,Rd	*Taglio longitudinale resistente*
V_c,Ed	*Taglio longitudinale sollecitante*		

Elem	part	Lcom	Type	V_c,Ed (N)	v_L,Ed (N/mm)	P_Rd_ser (N)	v_L,Rd (N/mm)
39	I[2]	sLCB4	Characteristic	-503688.9471	493.5438	2305851.2563	15372.3417
39	J[41]	sLCB4	Characteristic	71235.9937	69.8012	2305851.2563	15372.3417
47	I[10]	sLCB4	Characteristic	-326614.3270	334.9586	2305851.2563	15372.3417
47	J[49]	sLCB4	Characteristic	10596.5117	10.8672	2305851.2563	15372.3417
48	I[11]	sLCB4	Characteristic	-326602.1868	334.9461	2305851.2563	15372.3417
48	J[50]	sLCB4	Characteristic	10608.6519	10.8797	2305851.2563	15372.3417
57	I[41]	sLCB4	Characteristic	73586.4716	72.1043	2305851.2563	15372.3417
57	J[22]	sLCB4	Characteristic	351953.2723	344.8644	2305851.2563	15372.3417
65	I[49]	sLCB4	Characteristic	11459.0811	11.7518	2305851.2563	15372.3417
65	J[30]	sLCB4	Characteristic	306267.7798	314.0922	2305851.2563	15372.3417
66	I[50]	sLCB4	Characteristic	11471.2205	11.7643	2305851.2563	15372.3417
66	J[31]	sLCB4	Characteristic	306279.9192	314.1047	2305851.2563	15372.3417

6.7. SOLETTA IMPALCATO

6.7.1. Fase 1 - Soletta prefabbricata autoportante

Fin dalla posa sulle travi metalliche, le lastre prefabbricate ed i loro tralicci subiscono diverse fasi di carico. Le azioni sollecitanti si ripartiscono di volta in volta lungo i correnti superiori ed inferiori del traliccio in acciaio oppure all'interno della sezione in C.A. della soletta. I momenti flettenti provocati dai carichi di progetto provocano azioni assiali di trazione e compressione sui correnti superiori ed inferiori mentre gli effetti del taglio provocano azioni assiali sulle diagonali del traliccio (staffe).

Le lastre utilizzate hanno le seguenti caratteristiche:

Larghezza lastra	$L = 240$ cm	Diametro barra superiore	$\phi_{sup} = 14$ mm
Spessore lastra	$s = 6$ cm	Area barra superiore	$A_{sup} = 154$ mm^2
Numero tralicci	$n = 6$	Diametro barra inferiore	$\phi_{inf} = 12$ mm
Interasse tra i tralicci	$i = \frac{L}{n} = \frac{240}{6} = 40$ cm	Area barre inferiori	$A_{inf} = 226$ mm^2
Passo del traliccio	$p = 20$ cm	Diametro staffa	$\phi_{staffa} = 10$ mm
Larghezza inferiore traliccio	$d = 10{,}8$ cm	Area staffa	$A_{staffa} = 79$ mm^2
Altezza traliccio	$h = 16{,}5$ cm	Tensione snervamento acciaio	$f_{yk} = 450$ N/mm^2

Nelle successive figure sono riportate le caratteristiche geometriche delle lastre e dei tralicci definite in precedenza.

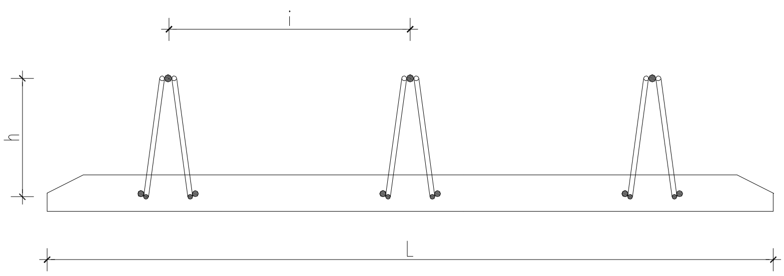


Figura 6.25 : Lastra prefabbricata

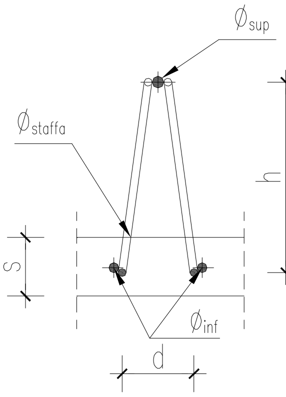


Figura 6.26 : Schema trasversale traliccio

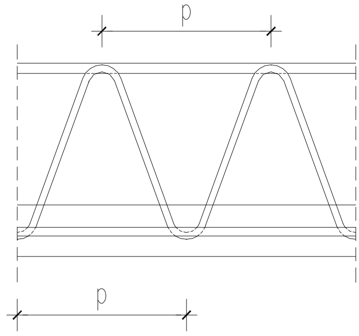


Figura 6.27 : Schema longitudinale traliccio

In questa prima fase si verifica l'autoportanza delle lastre prefabbricate che, oltre al loro peso proprio, devono sopportare il sovraccarico del getto della soletta. Nel calcolo delle sollecitazioni agenti si dovrà tener conto del carico dovuto agli operatori ed alle attrezzature utilizzate durante la fase di getto, nonché dell'effetto dinamico provocato dalle stesse operazioni di getto.

Analisi dei carichi

Lo schema statico delle lastre è quello di trave in semplice appoggio.

I carichi agenti sono i seguenti:

Peso proprio lastra prefabbricata $g_{lastra} = s \cdot \gamma_{CA} = 0{,}07 \times 25 = 1{,}75$ kN/m

Peso getto soletta $g_{soletta} = (H - s) \cdot \gamma_{CA} = (0{,}25 - 0{,}07) \times 25 = 4{,}40$ kN/m

Carico accidentale fase di getto $q_{getto} = 1{,}00$ kN/m

Combinazione dei carichi

Stato limite ultimo $p_{slu} = \gamma_g \cdot (g_{lastra} + g_{soletta}) + \gamma_q \cdot q_{getto}$

$$p_{slu} = 1{,}35 \cdot (1{,}75 + 4{,}50) + 1{,}5 \cdot 1{,}00 = 9{,}94 \text{ kN/m}$$

Determinazione delle sollecitazioni

La luce di calcolo è pari a = 3,20 m.

Momento massimo campata $M_{Sd,cam} = 12{,}72$ kNm/m

Taglio massimo appoggio $V_{Sd,app} = 15{,}90$ kN/m

Verifica sezione all'appoggio

Staffa (barra inclinata del traliccio)

L'azione tagliante provoca sulle barre dei tralicci inclinati la seguente azione assiale:

$$N_{Sd,app,staffa} = \frac{s \cdot V_{Sd,app}}{2 \cdot \sin\alpha_1 \cdot \sin\alpha_2} = 5{,}00 \text{ kN}$$

Inclinazione piano longitudinale $\alpha_1 = \arctan \frac{h}{d/2} = 39{,}52°$

Inclinazione piano trasversale $\alpha_2 = \arctan \frac{h}{p} = 88{,}26°$

Si verifica, dunque:

$$l_0 = \sqrt{(p/2)^2 + h^2 + (d/2)^2} = 193 \text{ mm}$$

$$\lambda = \frac{l_0}{\phi_{staffa}/4} = 77$$

$$\lambda_l = 93{,}9 \cdot \sqrt{\frac{235}{f_y}} = 69{,}42$$

Snellezza adimensionale $\bar{\lambda} = \frac{\lambda}{\lambda_l} = 1{,}11$

$\alpha = 0{,}49$

Fattore di imperfezione $\phi = 0{,}5 \cdot \left[1 + \alpha \cdot \left(\bar{\lambda} - 0{,}2\right)\right] + \bar{\lambda}^2 = 1{,}34$

Coefficiente di riduzione $\chi = \frac{1}{\phi + \sqrt{\phi^2 + \bar{\lambda}^2}} = 0{,}4778$

Resistenza a compressione $N_{Rd,staffa} = \chi \cdot A_{staffa} \cdot \frac{f_y}{\gamma_{M1}} = 15{,}37 \text{ kN} \quad > \quad N_{Sd,a,staffa}$

Verifica sezione in campata

Correnti

Trascurando il contributo del calcestruzzo, l'azione assiale sulle armature superiori ed inferiori è pari a:

$$N_{Sd,cam} = M_{Sd,cam} \cdot \frac{i}{h} = 30{,}84 \text{ kN}$$

Considerando, per le barre compresse, una lunghezza libera di inflessione pari al passo del traliccio, si calcola:

$$\lambda = \frac{p}{\phi_{sup}/4} = 57$$

$$\lambda_l = 93{,}9 \cdot \sqrt{\frac{235}{f_y}} = 69{,}42$$

Snellezza adimensionale $\bar{\lambda} = \frac{\lambda}{\lambda_1} = 0{,}82$

$\alpha = 0{,}49$

Fattore di imperfezione $\phi = 0{,}5 \cdot \left[1 + \alpha \cdot \left(\bar{\lambda} - 0{,}2\right)\right] + \bar{\lambda}^2 = 0{,}99$

Coefficiente di riduzione $\chi = \frac{1}{\phi + \sqrt{\phi^2 + \bar{\lambda}^2}} = 0{,}6476$

Resistenza a trazione $N_{Rd,\inf} = A_{\inf} \cdot \frac{f_y}{\gamma_{M1}} = 92{,}63 \text{ kN} \quad > \quad N_{Sd,cam}$

Resistenza a compressione $N_{Rd,\sup} = \chi \cdot A_{\inf} \cdot \frac{f_y}{\gamma_{M1}} = 40{,}83 \text{ kN} \quad > \quad N_{Sd,cam}$

6.7.2. Fase 2 - Maturazione getto di completamento

In questa fase l'armatura della porzione dei soletta già maturata è la sola armatura integrativa. Si trascura a favore di sicurezza la resistenza residua dei ferri del traliccio delle lastre prefabbricate, già tensionati nelle fasi precedenti. Si considera nel calcolo una profondità di soletta pari ad 1,00 m.

<u>*Analisi dei carichi*</u>

Nel calcolo delle sollecitazioni non si considera il peso proprio della soletta in cemento armato; quest'ultima viene considerata nella verifica dei travetti delle lastre prefabbricate in fase di getto. Per coerenza, ed a favore di sicurezza, le armature già verificate in fase di getto non saranno considerate nelle verifiche della soletta gettata in opera.

Permanenti

Peso pavimentazione $g_{pavimentazione} = s \cdot \gamma_{pav} = 0{,}18 \times 22{,}0 = 3{,}96 \text{ kN/m}^2$

Carichi mobili

Il veicolo tipo è disposto sulla sezione trasversale dell'impalcato in modo da massimizzare il momento negativo nell'appoggio intermedio ed il momento positivo in campata.

Momento massimo in campata

I carichi concentrati da considerarsi ai fini delle verifiche locali si assumono uniformemente distribuiti sulla superficie della rispettiva impronta. La diffusione attraverso la pavimentazione e lo spessore della soletta si considera avvenire secondo un angolo di 45°, fino al piano medio della struttura della soletta sottostante (si veda figura 6.28).

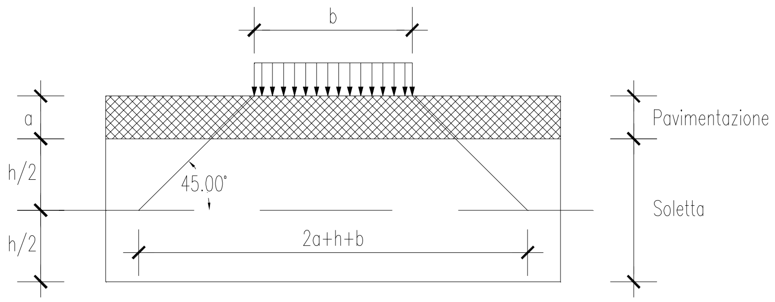


Figura 6.28 : Diffusione impronta di carico

Impronta ruota	$b = 0{,}40$ m
Altezza pavimentazione	$a = 0{,}18$ m
Altezza soletta	$h = 0{,}25$ m
Diffusione carico	$d = 2 \cdot a + h + b = 1{,}01$ m

Nella direzione trasversale, le tensioni si distribuiscono fino alla sezione in appoggio per una larghezza B come indicato in figura 6.29.

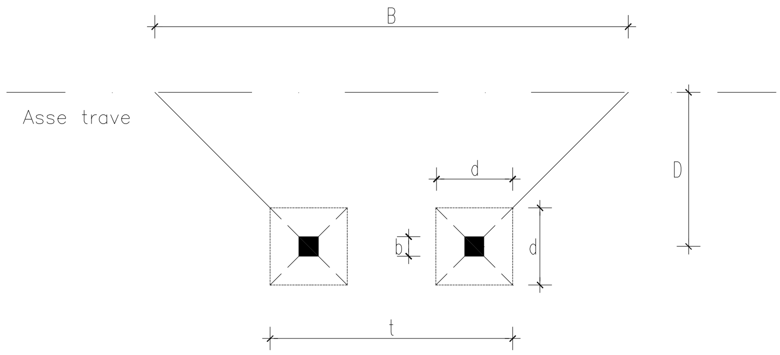


Figura 6.29 : Larghezza collaborante

- Momento massimo in campata

Distanza appoggio $D = 1{,}82$ m

$t = 1{,}20 + d = 2{,}21$ m

Larghezza collaborante $B_{cam} = t + 2 \cdot \left(D - \frac{d}{2} \right) = 4{,}84$ m

Sollecitazioni e verifiche sezionali

- Momento massimo in campata

Permanente $M_{per} = 6{,}58$ kNm/m

$V_{per} = 0{,}00$ kN/m

Accidentale $M_{acc} = 367{,}05$ kNm

$V_{acc} = 0{,}00$ kN

Combinazione SLU $M_{cam} = 1{,}35 \cdot M_{per} + 1{,}35 \cdot \frac{M_{acc}}{B_{cam}} = 111{,}26$ kNm/m

$V_{cam} = 1{,}35 \cdot V_{per} + 1{,}35 \cdot \frac{V_{acc}}{B_{cam}} = 0{,}00$ kN/m

Combinazione SLE - Freq. $M_{cam} = 1{,}00 \cdot M_{per} + 0{,}75 \cdot \frac{M_{acc}}{B_{cam}} = 63{,}46$ kNm/m

6.7.3. Verifica sezionale

Si riporta la verifica sezionale della soletta.

Metodo di calcolo resistenza:	Stati Limite Ultimi
Normativa di riferimento:	N.T.C.
Tipologia sezione:	Sezione predefinita
Forma della sezione:	Rettangolare
Percorso sollecitazione:	A Sforzo Norm. costante
Condizioni Ambientali:	Poco aggressive
Riferimento Sforzi assegnati:	Assi x,y principali d'inerzia

CARATTERISTICHE DI RESISTENZA DEI MATERIALI IMPIEGATI

CALCESTRUZZO -	Classe:	C28/35	
	Resistenza compress. di calcolo fcd:	15.86	MPa
	Resistenza compress. ridotta fcd':	7.930	MPa
	Deform. unitaria max resistenza ec2:	0.0020	
	Deformazione unitaria ultima ecu:	0.0035	
	Diagramma tensioni-deformaz.:	Parabola-Rettangolo	
	Modulo Elastico Normale Ec:	32308.0	MPa
	Coeff. di Poisson:	0.20	
	Resis. media a trazione fctm:	2.760	MPa
	Coeff.Omogen. S.L.E.:	15.0	
	Sc limite S.L.E. comb. Rare:	16.800	MPa
	Ap.Fessure limite S.L.E. comb. Rare:	99999.000	mm
	Sc limite S.L.E. comb. Frequenti:	16.800	MPa
	Ap.Fessure limite S.L.E. comb. Frequenti:	0.400	mm
	Sc limite S.L.E. comb. Q.Permanenti:	12.600	MPa
	Ap.Fessure limite S.L.E. comb. Q.Permanenti:	0.300	mm
ACCIAIO -	Tipo:	B450C	
	Resist. caratt. a snervamento fyk:	450.00	MPa
	Resist. caratt. a rottura ftk:	450.00	MPa
	Resist. a snerv. di calcolo fyd:	391.30	MPa
	Resist. ultima di calcolo ftd:	391.30	MPa
	Deform. ultima di calcolo Epu:	0.068	
	Modulo Elastico Ef:	200000.0	MPa
	Diagramma tensioni-deformaz.:	Bilineare finito	
	Coeff. Aderenza istant. ß1*ß2:	1.00	
	Coeff. Aderenza differito ß1*ß2:	0.50	
	Comb.Rare - Sf Limite:	360.00	MPa

CARATTERISTICHE GEOMETRICHE ED ARMATURE SEZIONE

Base:	150.0	cm

Altezza:	25.0	cm
Barre inferiori:	10Ø20	(31.4 cm²)
Barre superiori:	10Ø20	(31.4 cm²)
Coprif.Inf.(dal baric. barre):	8.0	cm
Coprif.Sup.(dal baric. barre):	4.0	cm

ST.LIM.ULTIMI - SFORZI PER OGNI COMBINAZIONE ASSEGNATA

N	Sforzo normale [kN] applicato nel baricentro (posit. se di compress.)
Mx	Coppia concentrata [kN m] applicata all'asse x baric. della sezione con verso positivo se tale da comprimere il lembo sup. della sezione
Vy	Taglio [kN] in direzione parallela all'asse y baric. della sezione
MT	Momento torcente [kN m]

N°Comb.	N	Mx	Vy	MT
1	0.00	166.89	0.00	0.00

COMB. RARE (S.L.E.) - SFORZI PER OGNI COMBINAZIONE ASSEGNATA

N	Sforzo normale [kN] applicato nel baricentro (positivo se di compress.)
Mx	Coppia concentrata in kNm applicata all'asse x baricenrico della sezione con verso positivo se tale da comprimere il lembo superiore della sezione

N°Comb.	N	Mx
1	0.00	123.63

COMB. FREQUENTI (S.L.E.) - SFORZI PER OGNI COMBINAZIONE ASSEGNATA

N	Sforzo normale [kN] applicato nel baricentro (positivo se di compress.)
Mx	Coppia concentrata in kNm applicata all'asse x baricenrico della sezione con verso positivo se tale da comprimere il lembo superiore della sezione

N°Comb.	N	Mx
1	0.00	95.19

COMB. QUASI PERMANENTI (S.L.E.) - SFORZI PER OGNI COMBINAZIONE ASSEGNATA

N	Sforzo normale [kN] applicato nel baricentro (positivo se di compress.)
Mx	Coppia concentrata in kNm applicata all'asse x baricenrico della sezione con verso positivo se tale da comprimere il lembo superiore della sezione

N°Comb.	N	Mx
1	0.00	9.87

RISULTATI DEL CALCOLO

Sezione verificata per tutte le combinazioni assegnate

Copriferro netto minimo barre longitudinali:	3.0	cm
Interferro netto minimo barre longitudinali:	11.0	cm

METODO AGLI STATI LIMITE ULTIMI - RISULTATI PRESSO-TENSO FLESSIONE

Ver	S = combinazione verificata / N = combin. non verificata
N	Sforzo normale assegnato [kN] (positivo se di compressione)
Mx	Momento flettente assegnato [kNm] riferito all'asse x baricentrico
N ult	Sforzo normale ultimo [kN] nella sezione (positivo se di compress.)
Mx ult	Momento flettente ultimo [kNm] riferito all'asse x baricentrico
Mis.Sic.	Misura sicurezza = rapporto vettoriale tra (N ult,Mx ult) e (N,Mx) Verifica positiva se tale rapporto risulta >=1.000
Yneutro	Ordinata [cm] dell'asse neutro a rottura nel sistema di rif. X,Y,O sez.
Mx sn.	Momento flettente allo snervamento [kNm]
x/d	Rapp. di duttilità a rottura solo se N = 0 (travi)

C.Rid.	Coeff. di riduz. momenti in travi continue [formula (4.1.1)NTC]

N°Comb	Ver	N	Mx	N ult	M ult	Mis.Sic.	Yn	M sn	x/d	C.Rid.
1	S	0.00	166.89	0.25	178.33	1.069	20.3	172.92	0.28	0.79

METODO AGLI STATI LIMITE ULTIMI - DEFORMAZIONI UNITARIE ALLO STATO ULTIMO

ec max	Deform. unit. massima del conglomerato a compressione
ec 3/7	Deform. unit. del conglomerato nella fibra a 3/7 dell'altezza efficace
Yc max	Ordinata in cm della fibra corrisp. a ec max (sistema rif. X,Y,O sez.)
ef min	Deform. unit. minima nell'acciaio (negativa se di trazione)
Yf min	Ordinata in cm della barra corrisp. a ef min (sistema rif. X,Y,O sez.)
ef max	Deform. unit. massima nell'acciaio (positiva se di compressione)
Yf max	Ordinata in cm della barra corrisp. a ef max (sistema rif. X,Y,O sez.)

N°Comb	ec max	ec 3/7	Yc max	ef min	Yf min	ef max	Yf max
1	0.00350	-0.00448	25.0	0.00052	21.0	-0.00917	8.0

COMBINAZIONI RARE IN ESERCIZIO - VERIFICA MASSIME TENSIONI NORMALI

Ver	S = combinazione verificata / N = combin. non verificata
Sc max	Massima tensione di compress.(+) nel conglom. in fase fessurata ([Mpa]
Yc max	Ordinata in cm della fibra corrisp. a Sc max (sistema rif. X,Y,O)
Sc min	Minima tensione di compress.(+) nel conglom. in fase fessurata ([Mpa]
Yc min	Ordinata in cm della fibra corrisp. a Sc min (sistema rif. X,Y,O)
Sf min	Minima tensione di trazione (-) nell'acciaio [Mpa]
Yf min	Ordinata in cm della barra corrisp. a Sf min (sistema rif. X,Y,O)
Dw Eff.	Spessore di conglomerato [cm] in zona tesa considerata aderente alle barre
Ac eff.	Area di congl. [cm²] in zona tesa aderente alle barre (verifica fess.)
Af eff.	Area Barre tese di acciaio [cm²] ricadente nell'area efficace(verifica fess.)
D barre	Distanza media in cm tra le barre tese efficaci (verifica fess. formule (7.11)(7.14)EC2

N°Comb	Ver	Sc max	Yc max	Sc min	Yc min	Sf min	Yf min	Dw Eff.	Ac Eff.	Af Eff.	D barre
1	S	12.30	25.0	0.00	18.2	-276.1	21.0	9.1	1364	31.4	14.9

COMBINAZIONI RARE IN ESERCIZIO - VERIFICA APERTURA FESSURE

Ver	S = combinazione verificata / N = combin. non verificata
Sclmax	Massima tensione nel conglomerato nello STATO I non fessurato [Mpa]
Sclmin	Minuma tensione nel conglomerato nello STATO I non fessurato [Mpa]
Sc Eff	Tensione al limite dello spessore teso efficace nello STATO I [Mpa]
K3	Coeff. di normativa = 0,25 (Sclmin + ScEff)/(2 Sclmin)
Beta12	Prodotto dei Coeff. di aderenza Beta1*Beta2
Eps	Deformazione unitaria media tra le fessure
Srm	Distanza media in mm tra le fessure
Ap.fess.	Apertura delle fessure in mm = 1,7*Eps*Srm

N°Comb	Ver	Sclmax	Sclmin	Sc Eff	K3	Beta12	Eps	Srm	Ap.Fess.
1	S	6.28	-6.70	-19.8	0.162	1.00	0.001146	226	0.440

COMBINAZIONI FREQUENTI IN ESERCIZIO - VERIFICA MASSIME TENSIONI NORMALI

N°Comb	Ver	Sc max	Yc max	Sc min	Yc min	Sf min	Yf min	Dw Eff.	Ac Eff.	Af Eff.	D barre
1	S	9.47	25.0	0.00	18.2	-212.6	21.0	9.1	1364	31.4	14.9

COMBINAZIONI FREQUENTI IN ESERCIZIO - VERIFICA APERTURA FESSURE

N°Comb	Ver	Sclmax	Sclmin	Sc Eff	K3	Beta12	Eps	Srm	Ap.Fess.
1	S	4.84	-5.16	-15.2	0.162	0.50	0.000911	226	0.350

COMBINAZIONI QUASI PERMANENTI IN ESERCIZIO - VERIFICA MASSIME TENSIONI NORMALI

N°Comb	Ver	Sc max	Yc max	Sc min	Yc min	Sf min	Yf min	Dw Eff.	Ac Eff.	Af Eff.	D barre
1	S	0.98	25.0	0.00	18.2	-22.0	21.0	9.1	1364	31.4	14.9

COMBINAZIONI QUASI PERMANENTI IN ESERCIZIO - VERIFICA APERTURA FESSURE

N°Comb	Ver	Sclmax	Sclmin	Sc Eff	K3	Beta12	Eps	Srm	Ap.Fess.
1	S	0.50	-0.53	-1.6	0.162	0.50	0.000044	226	0.017